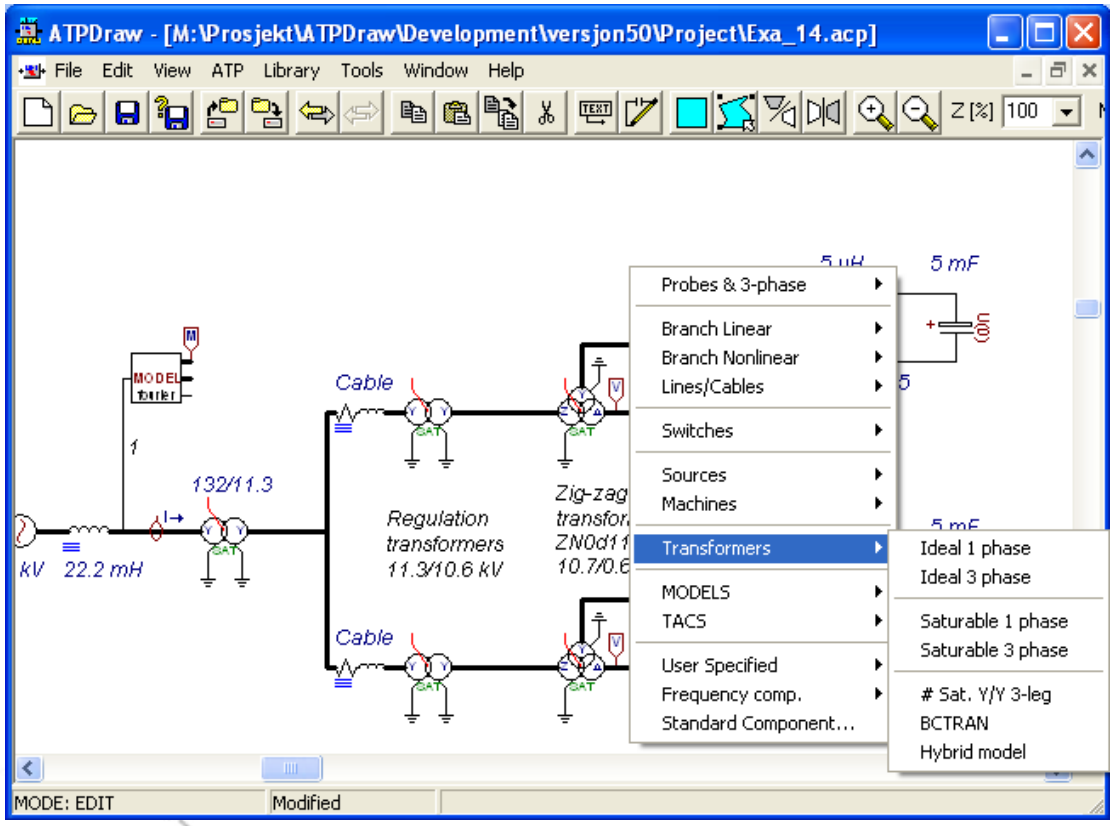
ATPDraw
Graphical Preprocessor to ATP



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Contents

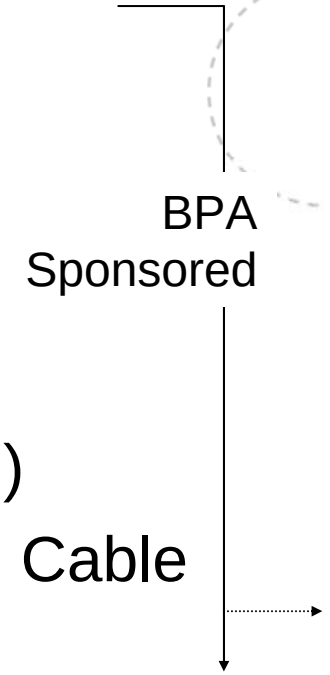
- Introduction
- Overview of ATPDraw functionality
- Examples
- Latest news in version 5.0-5.4

Introduction

- ATPDraw is a graphical, mouse-driven, dynamic preprocessor to ATP on the Windows platform
- Handles node names and creates the ATP input file based on ”what you see is what you get”
- Freeware
- Supports
  - All types of editing operations
  - ~100 standard components
  - ~60 TACS components
  - MODELS
  - $INCLUDE and User Specified Components
  - Groups

Introduction- ATPDraw history

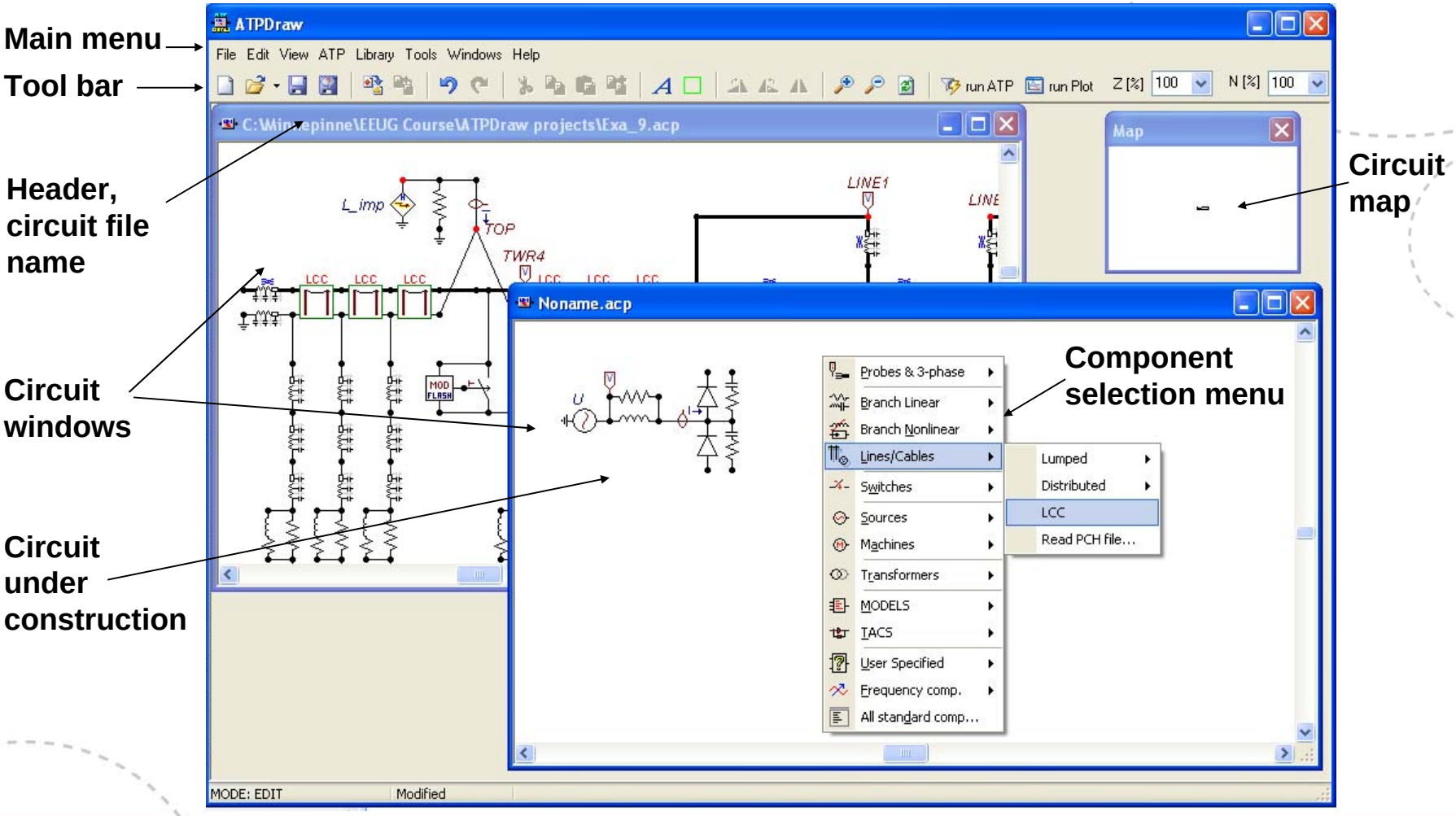
- Simple DOS version
  - Leuven EMTP Centre, fall meeting 1991, 1992
- Extended DOS versions, 1994-95
- Windows version 1.0, July 1997
  - Line/Cable modelling program ATP_LCC
  - User Manual
- Windows version 2.0, Sept. 1999
  - MODELS, more components (UM, SatTrafo ++)
  - Integrated line/cable support (Line Constants + Cable Parameters)



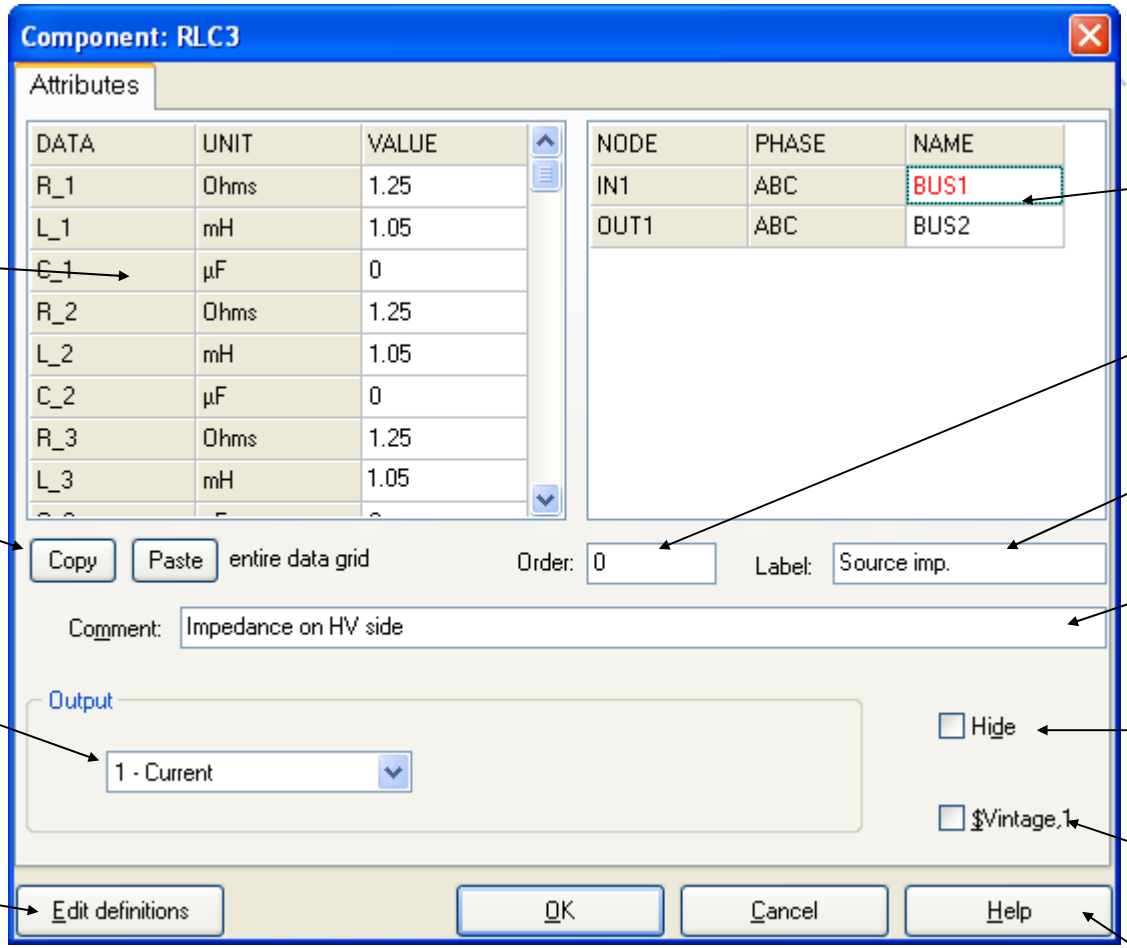
Introduction- ATPDraw history

- Windows version 3, Dec. 2001
  - Grouping/Compress
  - Data Variables, $Parameter + PCVP
  - LCC Verify + Cable Constants
  - BCTRAN
  - User Manual @ version 3.5
- Windows version 4, July 2004
  - Line Check
  - Hybrid Transformer model
  - Zigzag Saturable transformer
- Windows version 5, Oct. 2006
  - Vector graphics, multi-phase nodes, interactive Models integration, files in memory

ATPDraw functionality



ATPDraw Component dialog



Editable data values

Windows clipboard support

Branch output

Edit local definitions Icon/help/ pos/name/ units

Node names Red=User Spec.

Used for sorting

Label on screen

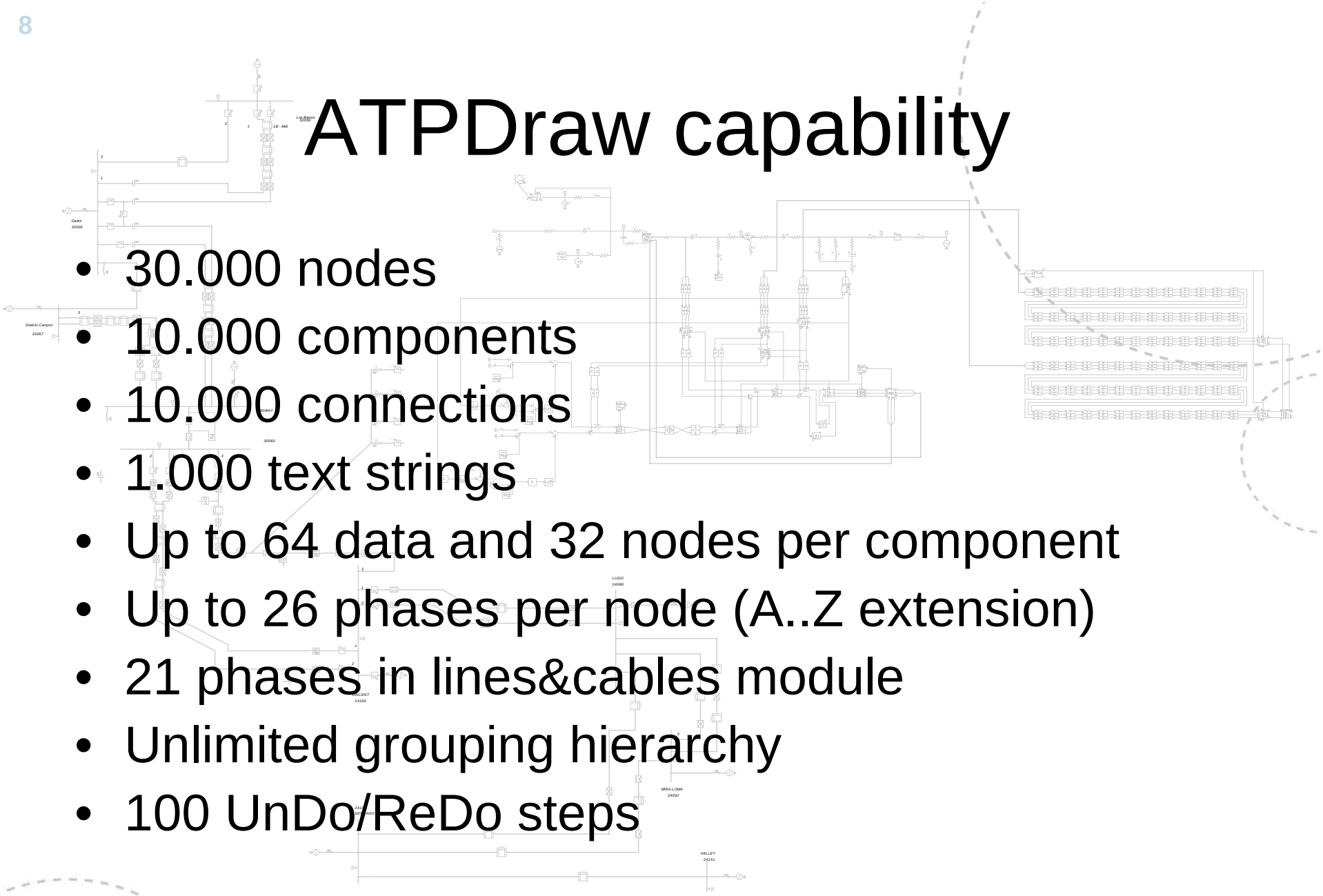
Comment in ATP file

Component not to ATP

High precision

Local help F1=Global help

ATPDraw capability

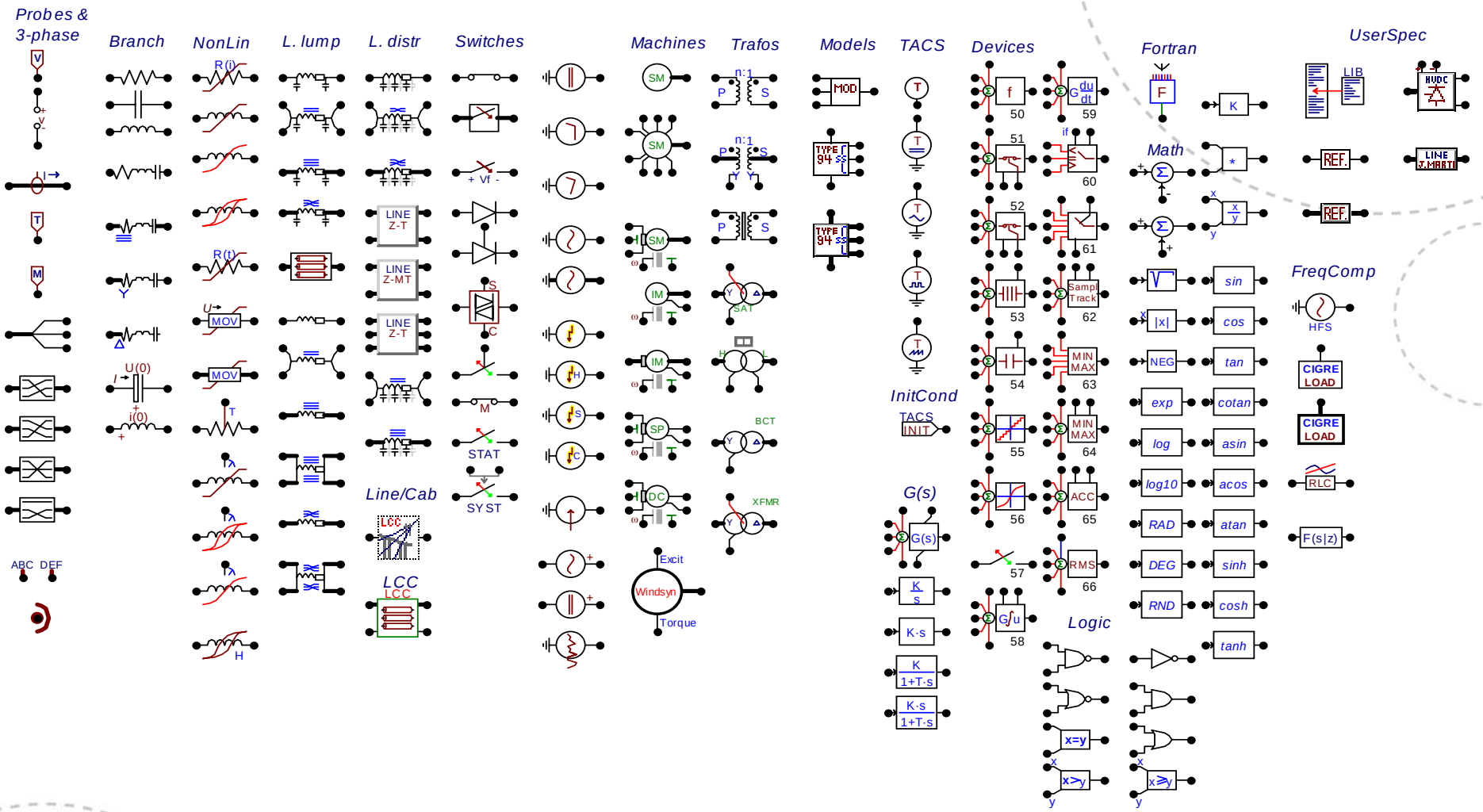


- 30.000 nodes
- 10.000 components
- 10.000 connections
- 1.000 text strings
- Up to 64 data and 32 nodes per component
- Up to 26 phases per node (A..Z extension)
- 21 phases in lines&cables module
- Unlimited grouping hierarchy
- 100 UnDo/ReDo steps

ATPDraw Edit options

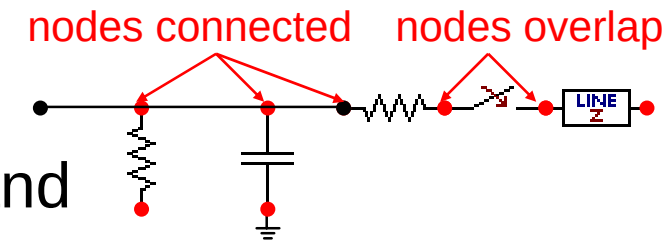
- Multiple documents
  - several circuit windows
  - large circuit windows (map+scroll)
  - grid snapping
- Circuit editing
  - Copy/Paste, Export/Import, Rotate/Flip, Undo/Redo (100), Zoom, Compress/Extract
  - Windows Clipboard: Circuit drawings, icons, text, circuit data
- Text editor
  - Viewing and editing of ATP, LIS, model files, and help files
- Help file system
  - Help on ATPDraw functionality, all components, and MODELS

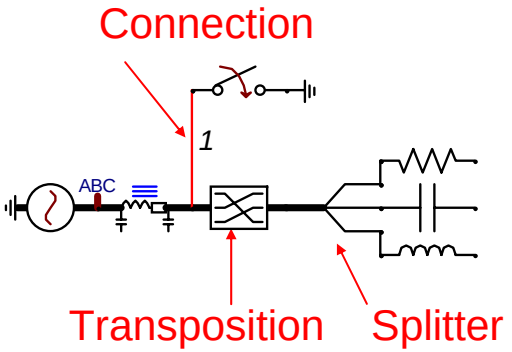
All standard components



ATPDraw node naming

- "What you see is what you get"
- Connected nodes automatically get the same name
  - Direct node overlap
  - Positioned on connection
- Warnings in case of duplicates and disconnections
- 3-phase and *n*-phase nodes
  - Extensions A..Z added automatically
  - Objects for transposition and splitting
  - Connection between *n*- and single phase



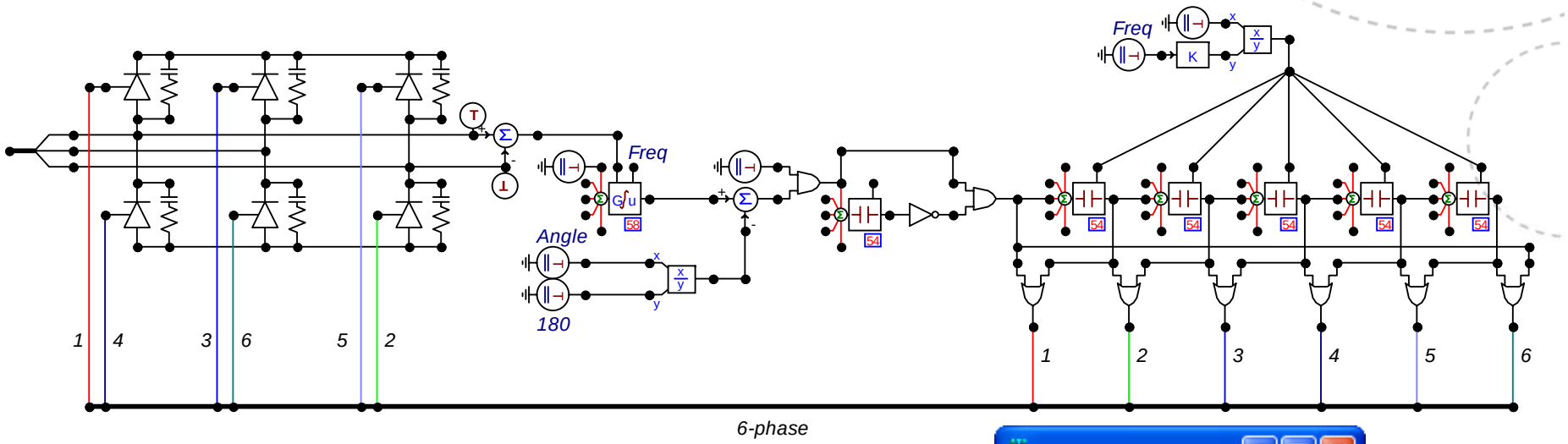


User's manual

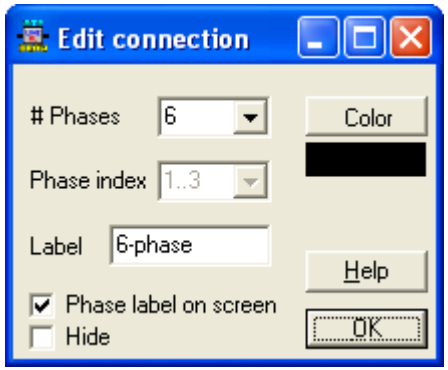
- Documents version 3.5 of ATPDraw (246 pages), pdf
- Written by Laszlo Prikler and H. K. Høidalen
- Content
  - Intro: To ATP and ATPDraw + Installation
  - Introductory manual: Mouse+Edit, MyFirstCircuit
  - Reference manual: All menus and components
  - Advanced manual: Grouping/LCC/Models/BCTRAN + create new components
  - Application manual: 9 real examples

Example 1

- Multi-phase connections



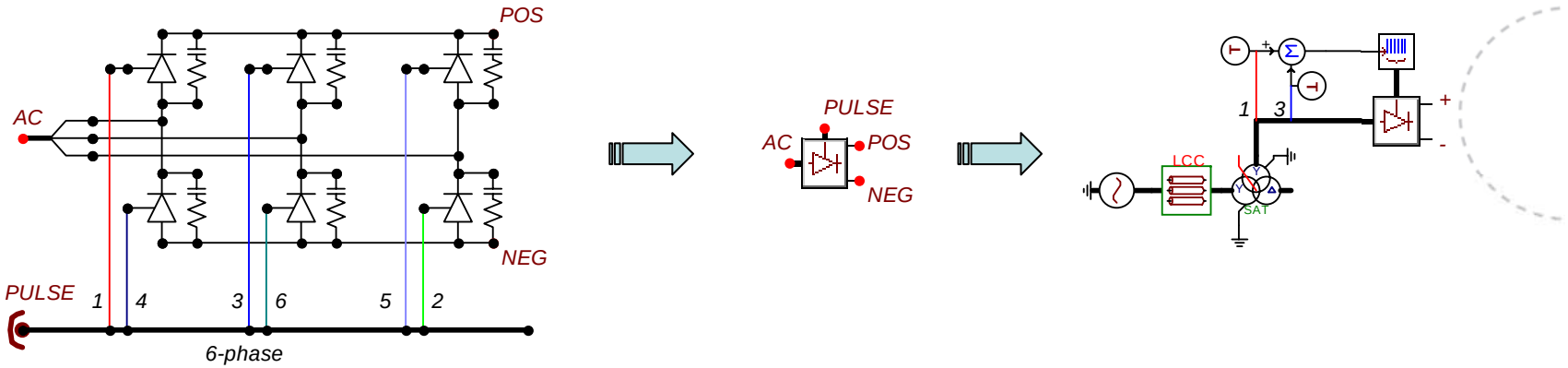
6-phase



- Increased circuit readability

Example 2

- Multi-phase groups



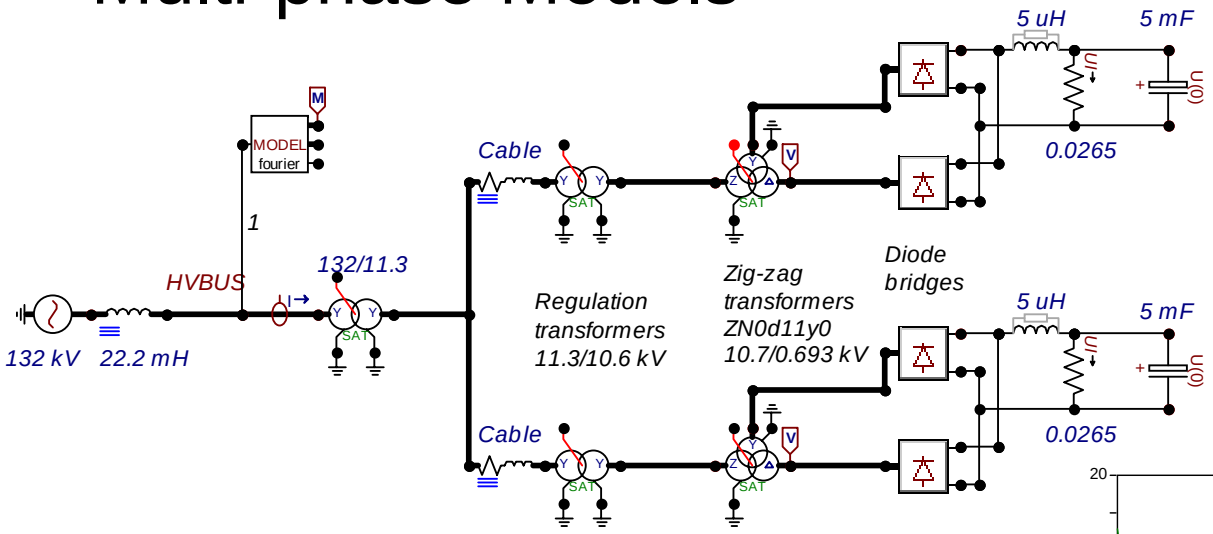
- New component: Collector

Example 3

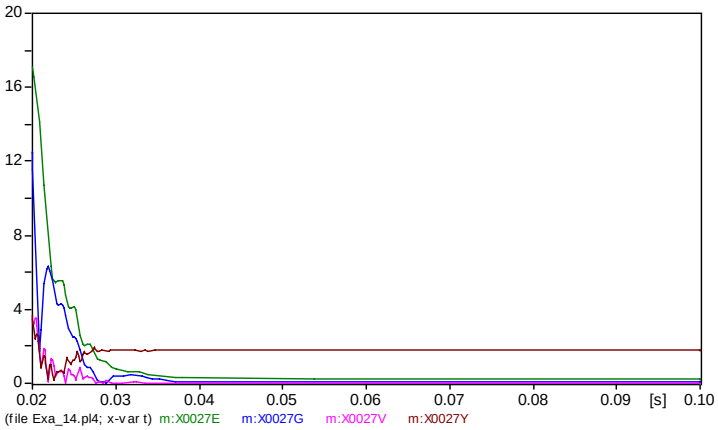
```
MODEL FOURIER
INPUT X               --input signal to be transformed
DATA  FREQ {DFLT:50} --power frequency
      n {DFLT:26}    --number of harmonics to calculate

OUTPUT absF[1..26], angF[1..26],F0 --DFT signals
VAR    absF[1..26], angF[1..26],F0,reF[1..26], imF[1..26],
       i,NSAMPL,OMEGA,D,F1,F2,F3,F4
```

- Multi-phase Models

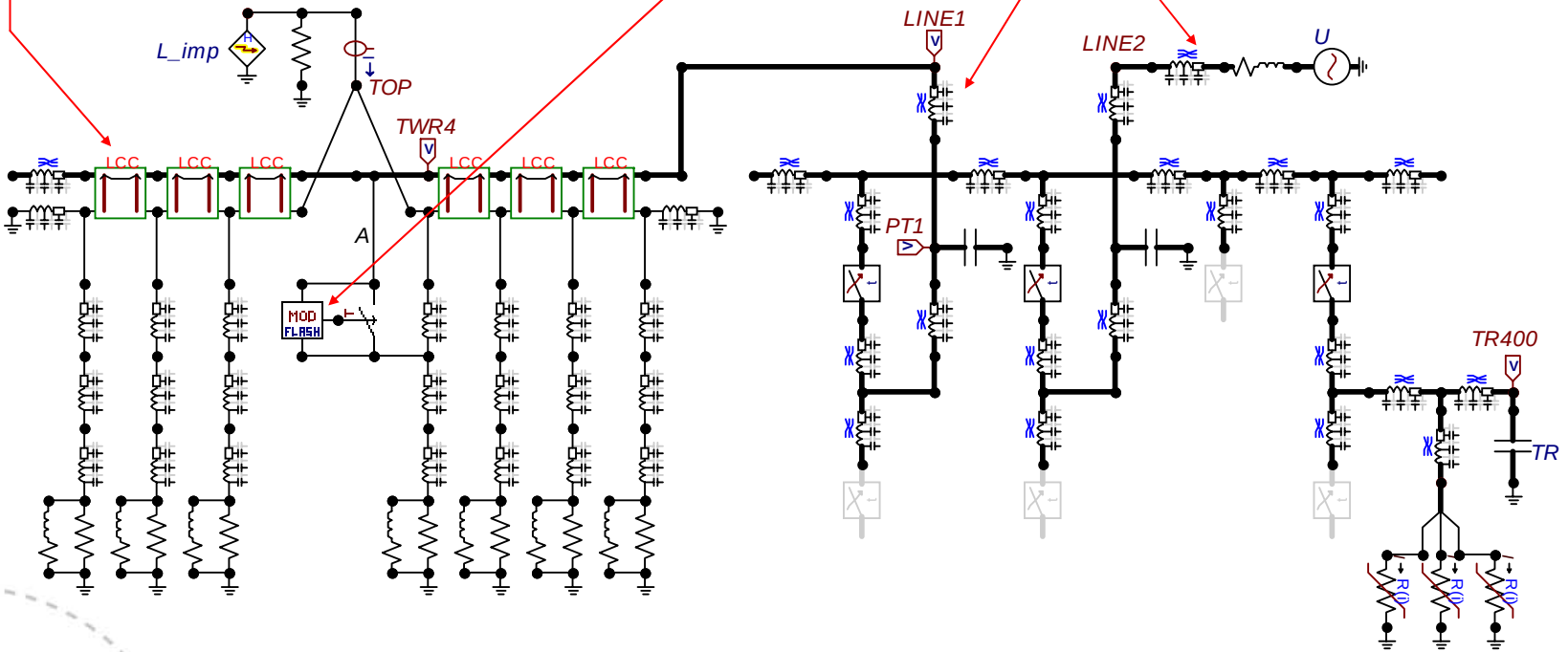


- New Model probe



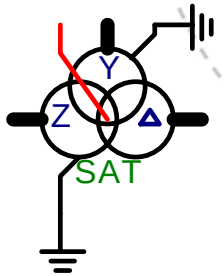
Example 4

- Lightning study
- JMarti lines
- Simple Bergeron lines in sub-station
- Flashover char. In MODELS

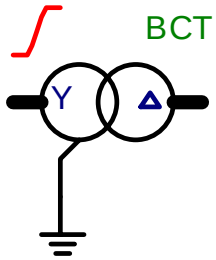


Transformer modeling

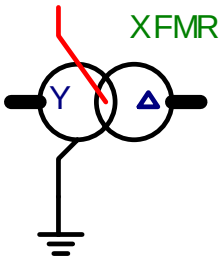
- Saturable Transformer



- BCTRAN



- Hybrid Transformer

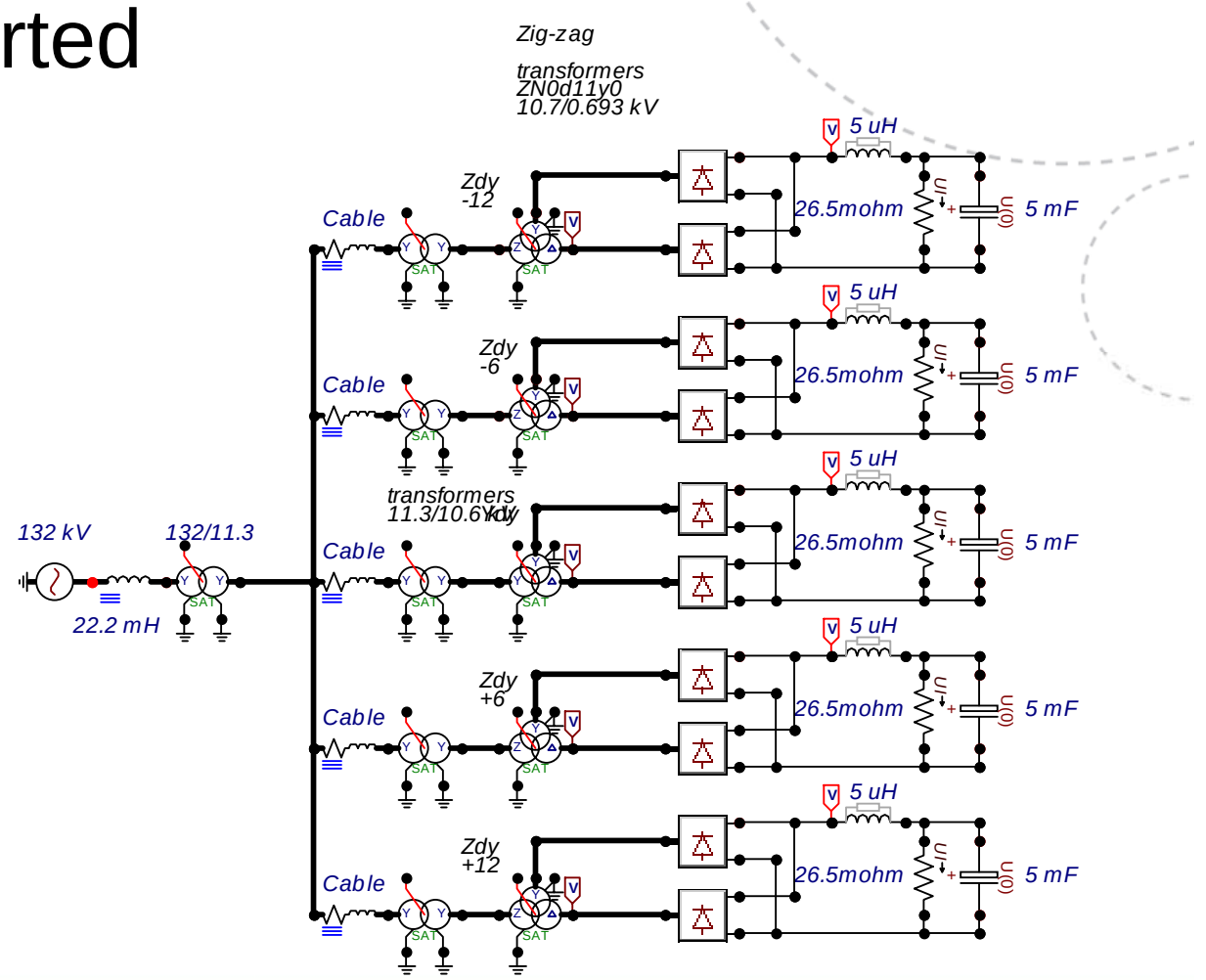


Saturable transformer

- Zigzag supported

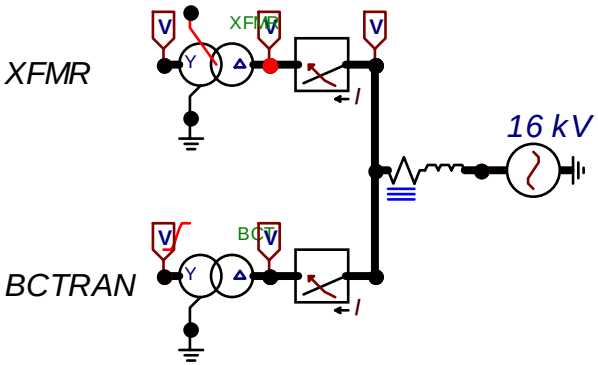
	Prim.	Sec.	Tert.
U [V]	85.92	2.11	1.23
R [ohm]	-0.064193	0.00019	6.6E-5
L [mH,ohm]	1.2260045	0.00973	0.00331
Coupling	Z	D	Y
Phase shift	-12	330	0
I(0)=	0	Rm=	0
F(0)=	0	R0=	1E12

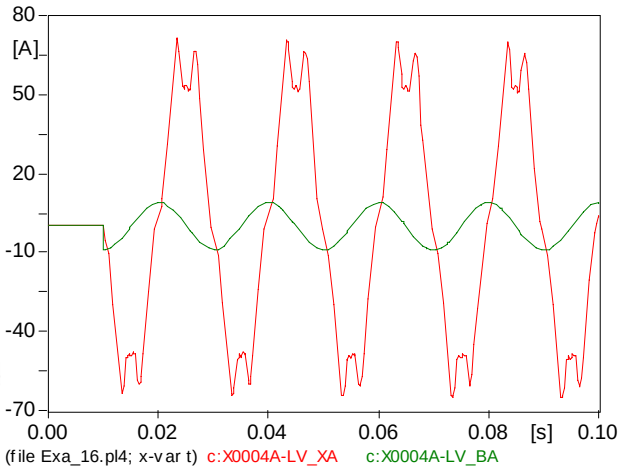
3-leg core
RMS
3-winding

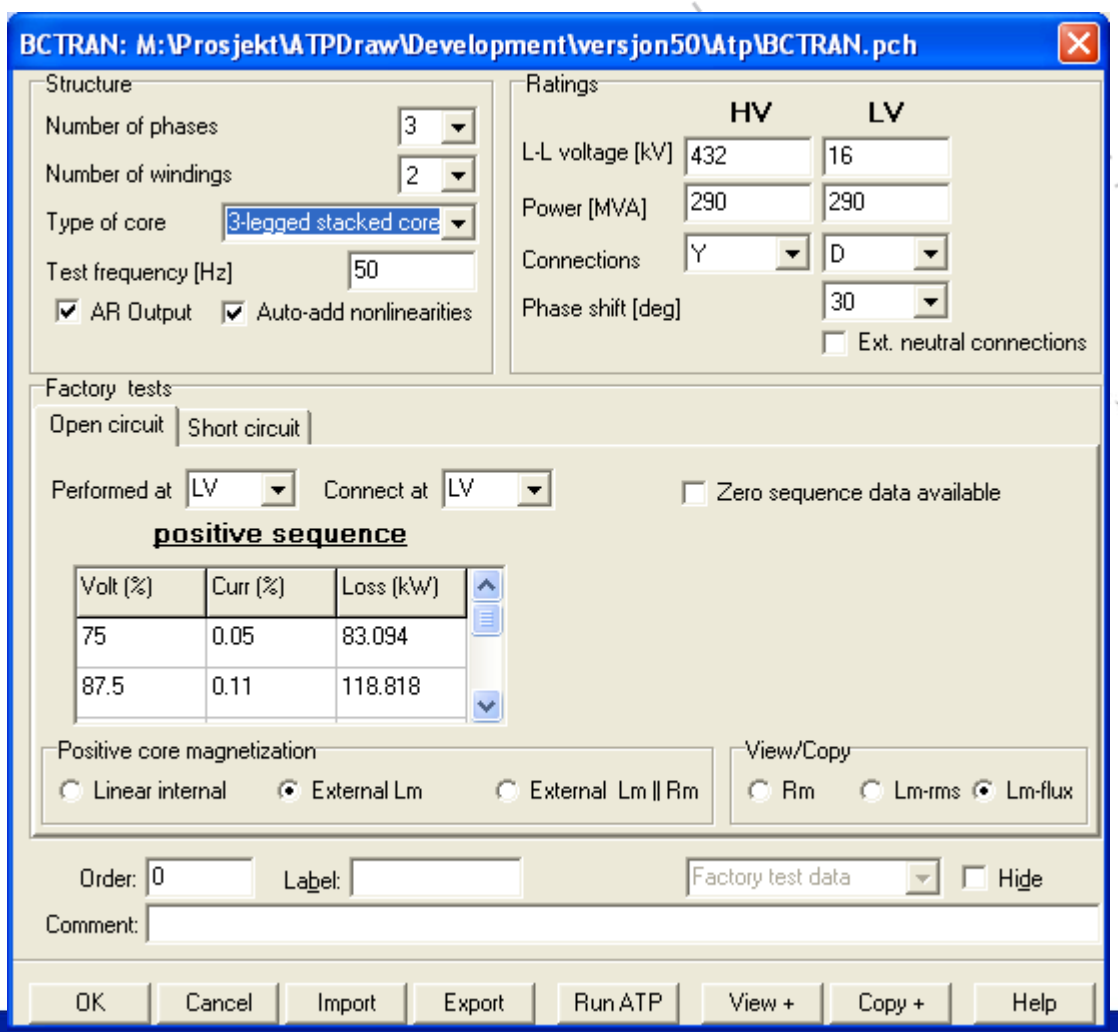


BCTRAN

- Automatic inclusion of external magnetization characteristic

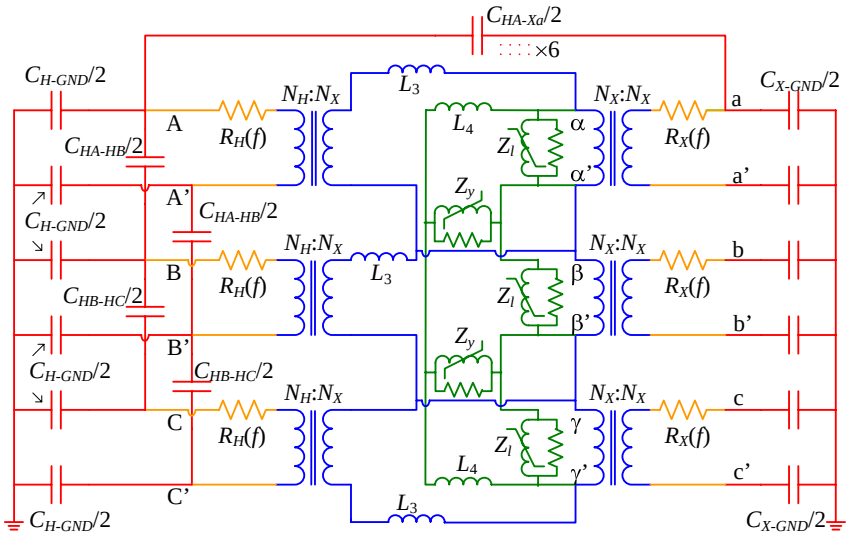


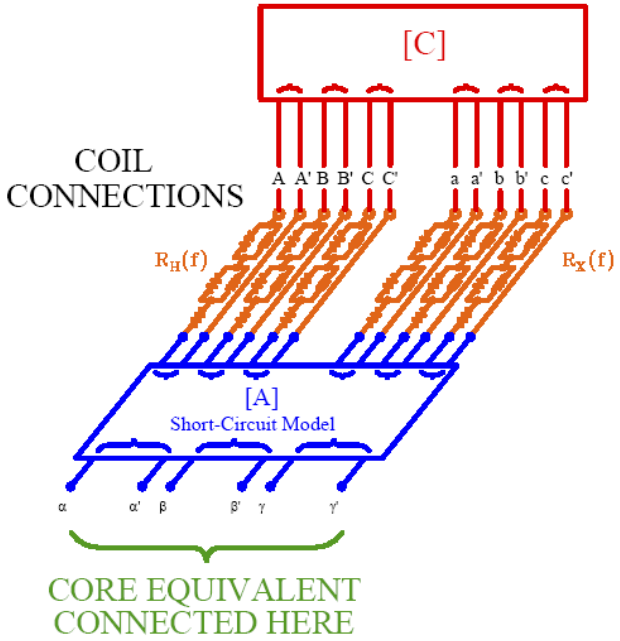




Hybrid transformer

- Four separate parts connected
  - Leakage: A-matrix; Auto, Y, D with all phase shifts
  - Winding resistance: Frequency dep. with Foster equiv.
  - Core: Topological correct core: Frolich equation, relative dimensions. Connected at *n*+1 winding at core surface.
  - Capacitance



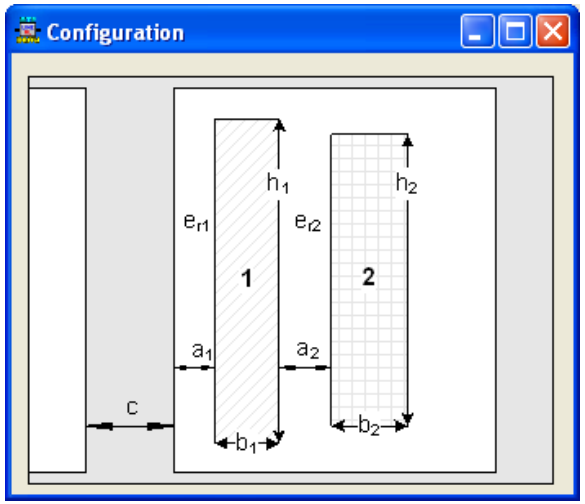


Hybrid cont.

- Design, test report, or typical values

Data based on	Ind.	Res.	Cap.	Core
Design param.	○	○	○	○
Test report	◉	◉	○	◉
Typical values	○	○	◉	○

Winding geometry



Open and short circuit test report

Inductance | Resistance | Capacitance | Core

Performed at: Sec

☑ Average currents ☐ Zero seq. available

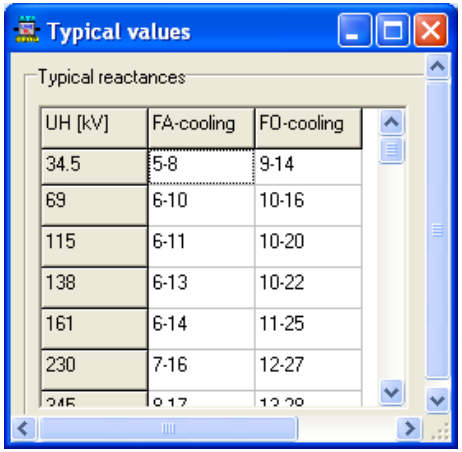
Insert | Delete

positive sequence @290 [MVA]

Volt [%]	Loss [kW]	Iav (%)
93.75	143.6	0.17
100	178.6	0.31

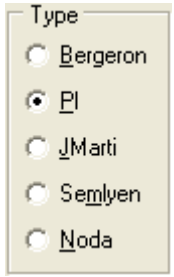
	Imp. (%)	Pow. (MVA)	Loss (kW)
P-S	14.6	290	704.4

Typical values from text books

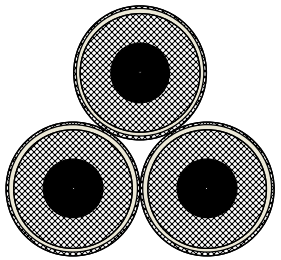


Line/Cable modeling

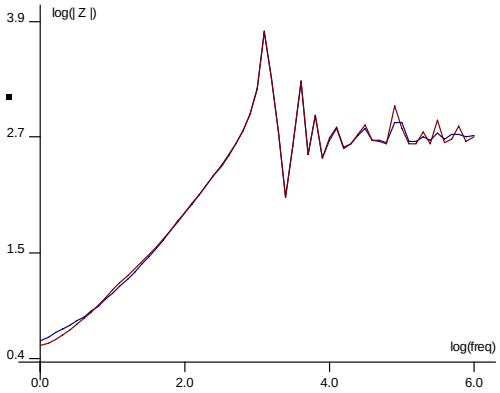
- Line/Cable Constants, Cable Parameters
  - Bergeron, PI, JMarti, Semlyen, Noda(?)



- View
  - Cross section, grounding



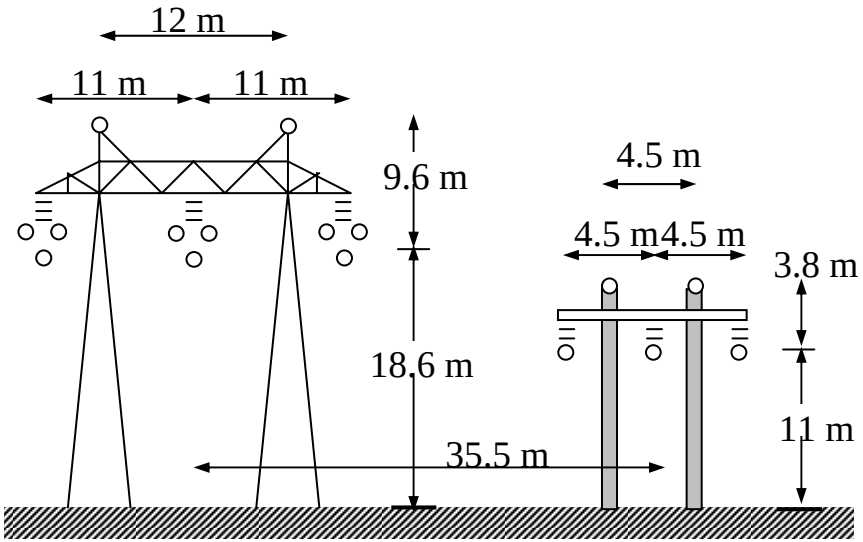
- Verify
  - Frequency response, power frequency params.



- Line Check
  - Power freq. test of line/cable sections

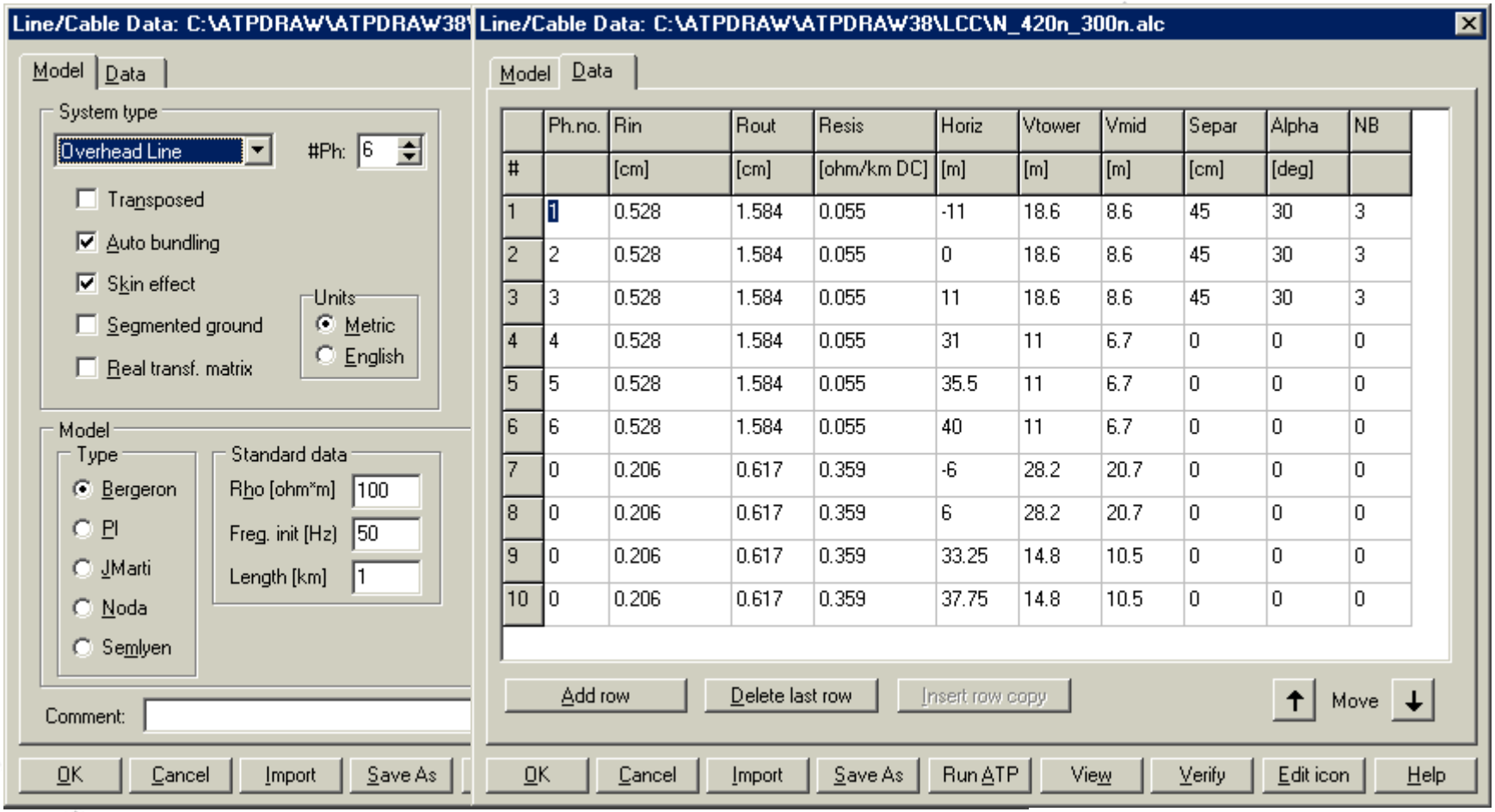
Example

- Double circuit case (420 kV + 145 kV)



Test type	Circuit [kV]	Positive sequence system Z [Ω/km]	C [nF/km]	Zero sequence system Z [Ω/km]	C [nF/km]
Benchmark data 50 Hz, 100 Ωm	420 145	**0.02+j0.29** **0.06+j0.38**	**12.8** **9.7**	**0.19+j0.71** **0.25+j0.80**	**9.3** **6.7**
Individual testing Bergeron model	420 145	0.02+j0.29 0.06+j0.38	12.8 9.7	0.18+j0.71 0.25+j0.80	9.3 6.9

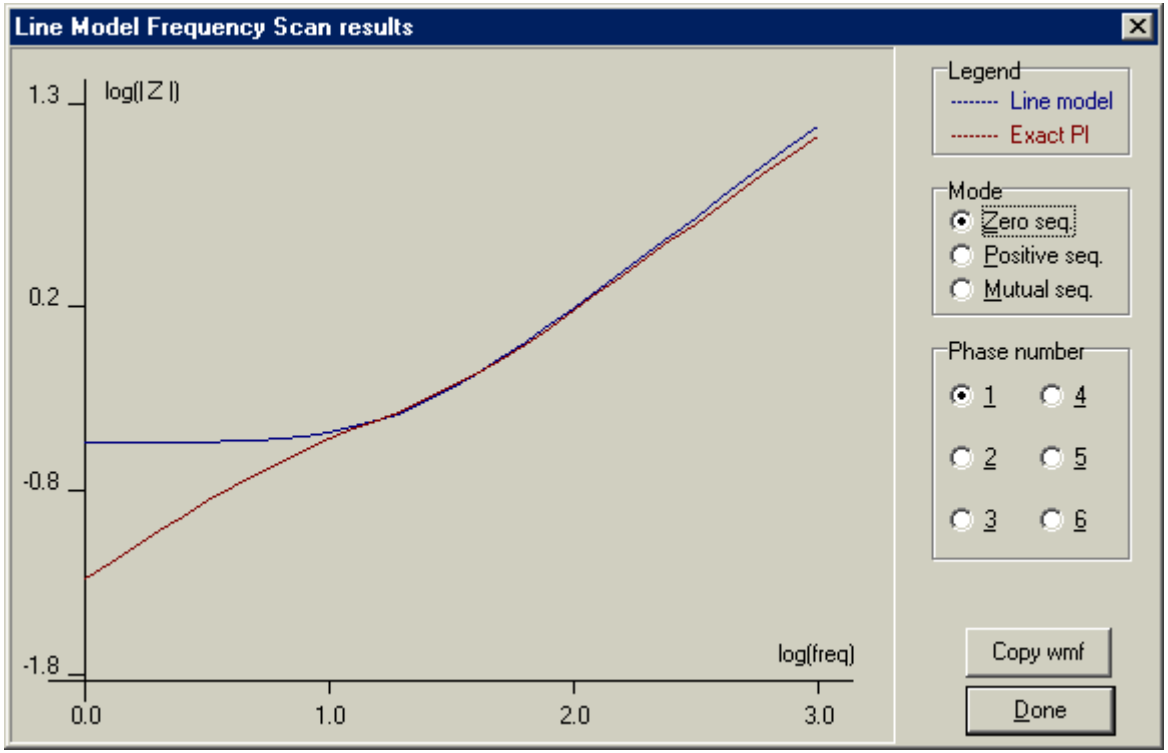
Creating the Bergeron model



#	Ph.no.	Rin [cm]	Rout [cm]	Resis [ohm/km DC]	Horiz [m]	Vtower [m]	Vmid [m]	Separ [cm]	Alpha [deg]	NB
1	1	0.528	1.584	0.055	-11	18.6	8.6	45	30	3
2	2	0.528	1.584	0.055	0	18.6	8.6	45	30	3
3	3	0.528	1.584	0.055	11	18.6	8.6	45	30	3
4	4	0.528	1.584	0.055	31	11	6.7	0	0	0
5	5	0.528	1.584	0.055	35.5	11	6.7	0	0	0
6	6	0.528	1.584	0.055	40	11	6.7	0	0	0
7	0	0.206	0.617	0.359	-6	28.2	20.7	0	0	0
8	0	0.206	0.617	0.359	6	28.2	20.7	0	0	0
9	0	0.206	0.617	0.359	33.25	14.8	10.5	0	0	0
10	0	0.206	0.617	0.359	37.75	14.8	10.5	0	0	0

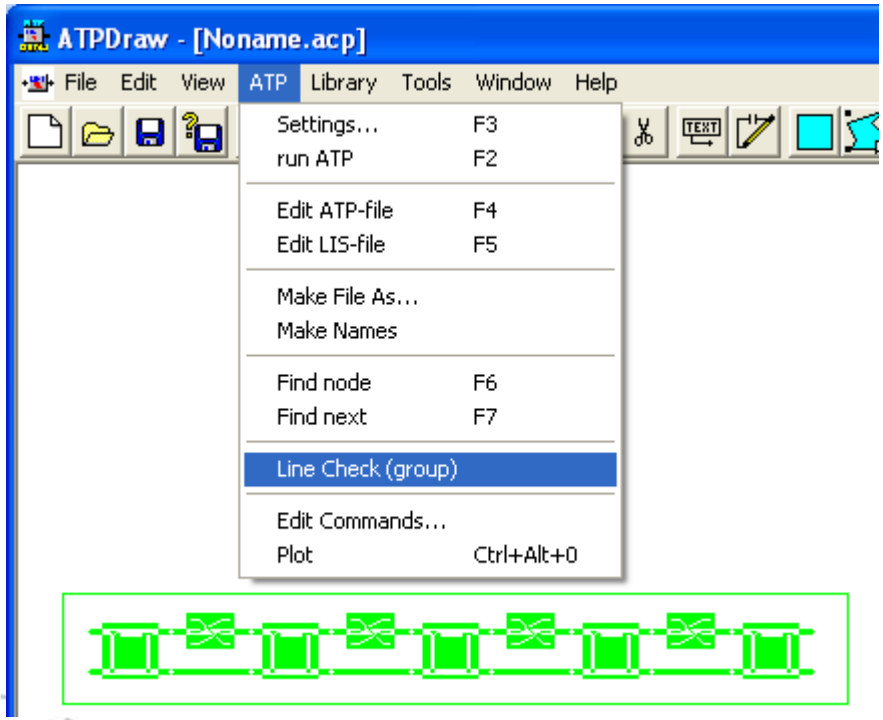
Testing the Bergeron model

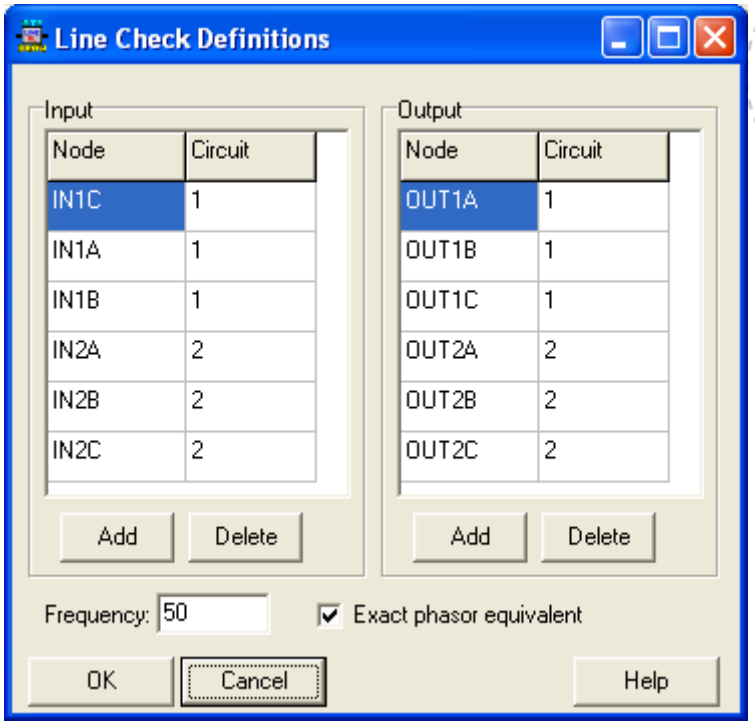
- Line Model Frequency scan. Model OK for 50 Hz.



Line Check

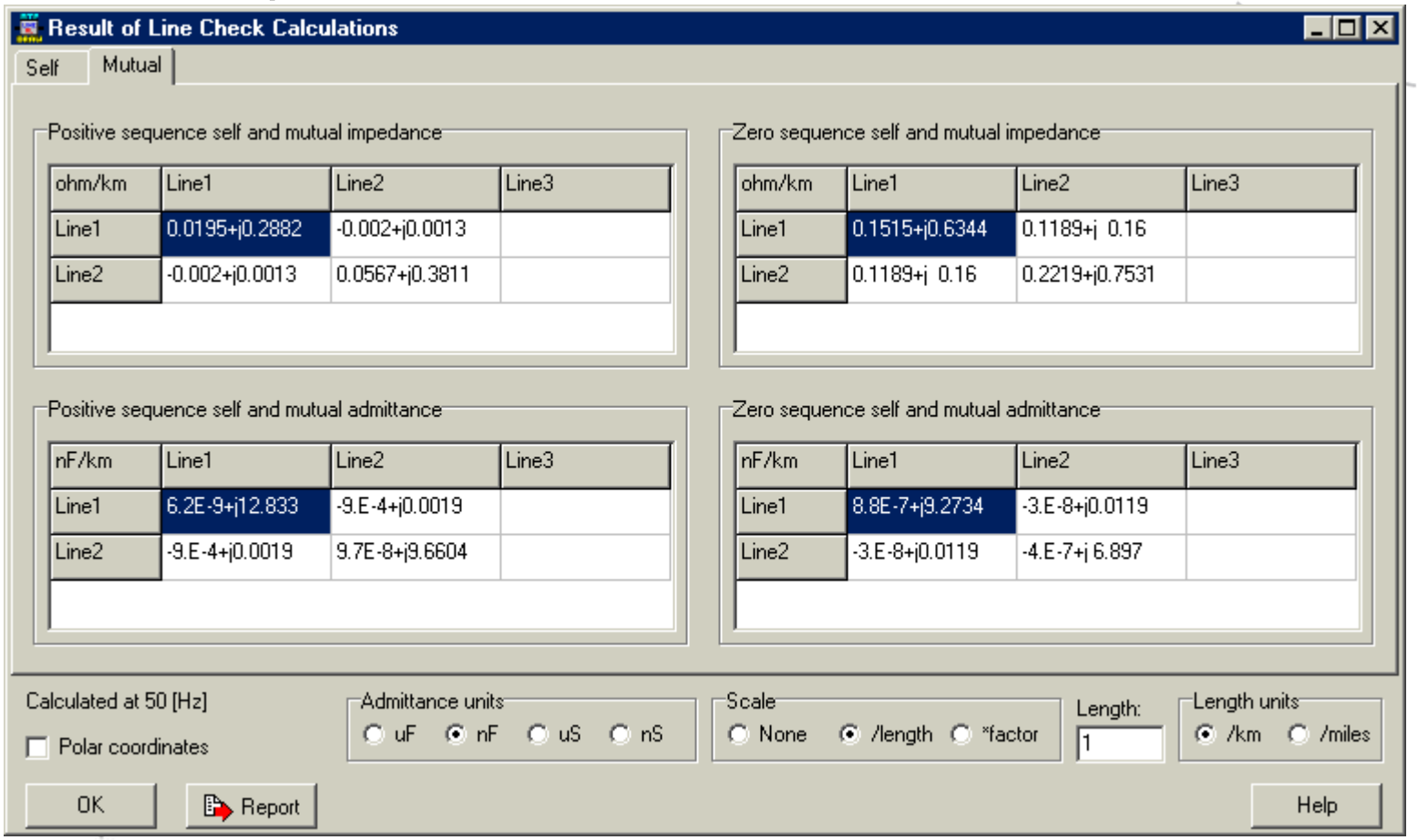
- The user selects a group in the circuit
- ATPDraw identifies the inputs and outputs (user modifiable)





Line Check cont.

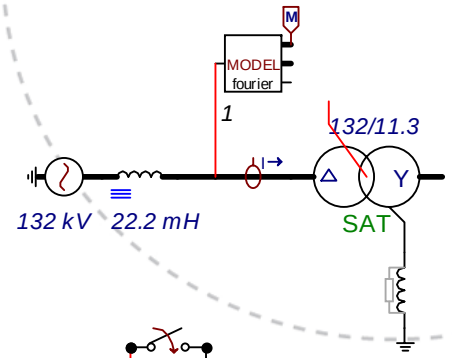
- ATPDraw reads the lis-file and calculates the series impedance and shunt admittance

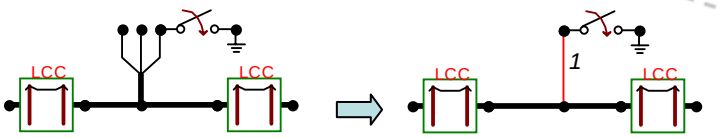

Result of Line Check Calculations
Self
Mutual
Positive sequence self and mutual impedance
ohm/km | Line1 | Line2 | Line3
Line1 | 0.0195+j0.2882 | -0.002+j0.0013 |
Line2 | -0.002+j0.0013 | 0.0567+j0.3811 |
Zero sequence self and mutual impedance
ohm/km | Line1 | Line2 | Line3
Line1 | 0.1515+j0.6344 | 0.1189+j 0.16 |
Line2 | 0.1189+j 0.16 | 0.2219+j0.7531 |
Positive sequence self and mutual admittance
nF/km | Line1 | Line2 | Line3
Line1 | 6.2E-9+j12.833 | -9.E-4+j0.0019 |
Line2 | -9.E-4+j0.0019 | 9.7E-8+j9.6604 |
Zero sequence self and mutual admittance
nF/km | Line1 | Line2 | Line3
Line1 | 8.8E-7+j9.2734 | -3.E-8+j0.0119 |
Line2 | -3.E-8+j0.0119 | -4.E-7+j 6.897 |
Calculated at 50 [Hz]
Polar coordinates
Admittance units
uF nF uS nS
Scale
None /length *factor
Length:
1
Length units
/km /miles
OK
Report
Help

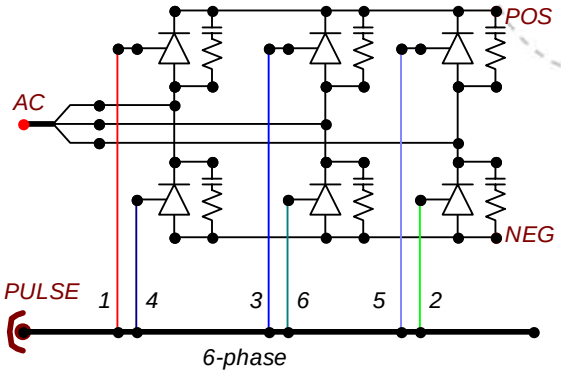
Latest news, Version 5.0 available from October 2006

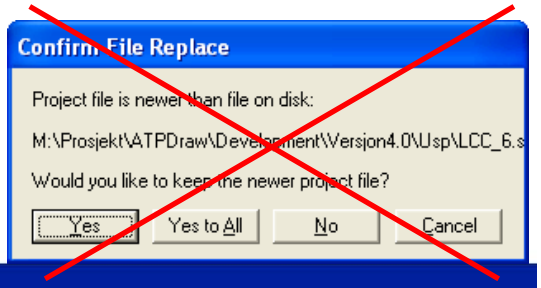
Sponsored by BPA & EEUG

- Vector graphics
  - Improved zoom
  - Larger, dynamic icon; RLC, transformer, switch…
  - Individual selection area
- Multi-phase nodes
  - 1..26 phases, A..Z extension
  - MODELS input/output X[1..26]
  - Connection between *n*-phase and single phase
  - 21 phases in LCC components
- New file management
  - Project file follows the PKZIP 2 format. Improved compression. acp-extension.
  - Sup-file only used when a component is created.
  - External data moved from files to memory.
  - Individual, editable help strings for all components.



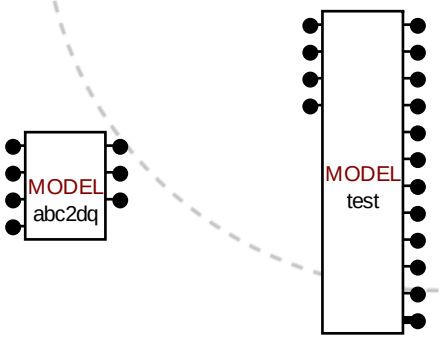




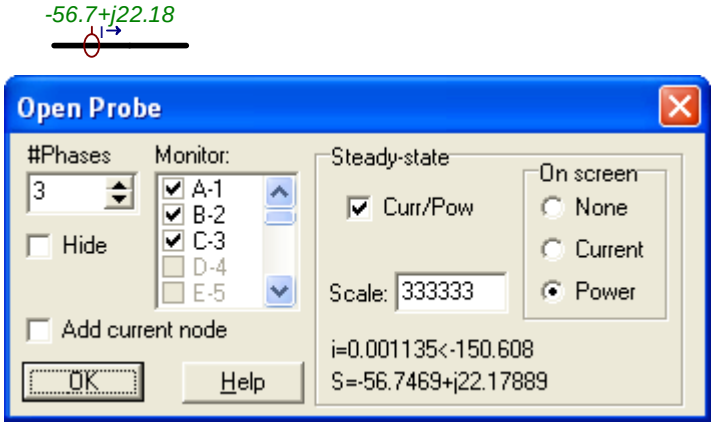


Latest news, continued

- MODELS fully integrated
  - No files on disk
  - Dynamic update of the component based on the Model's header
- Object size increased to 32 nodes and 64 data.
- Increased name and label strings. Unit added.
- Extended probe reads the lis-file and displays steady-state values
- Recompress of Groups supported.
- Undo/Redo updated. Possible to Undo "external" data editing.
- Type 1 source added.
- $Parameter for Models supported.
- Bug corrections



DATA	UNIT	VALUE
R	Ohms	1.23
L	Ohm	0.001
C	µF	0
Amplitude	Volt	10000
f	Hz	60
Pha	Deg/Rad	0



Integrated handling of MODELS

- Possible to edit a Model from the Component dialog
- The object in the circuit will be updated automatically
  - Inputs/outputs
  - Data
  - Dialog box
  - Icon
- Handling of indexed data
- Equal Models elsewhere are updated
- No files involved

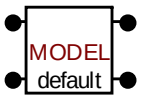
Add a new Model to a circuit

- Select a mod or sup file from the global library

  - If a sup-file does not exist, default data is used and icon automatically created

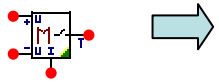
- Create a new Model

  - Default Model is used (ModelDef.sup from ATPDraw.scl)
  - Icon is automatically created

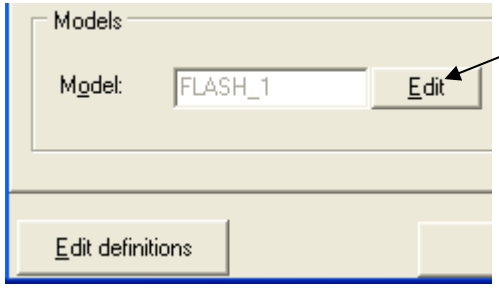


Edit a Model in a circuit

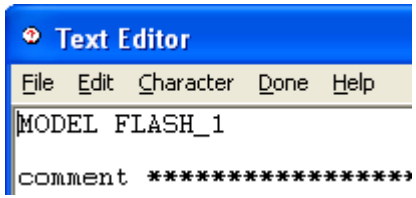
- In the Component dialog box click on Edit

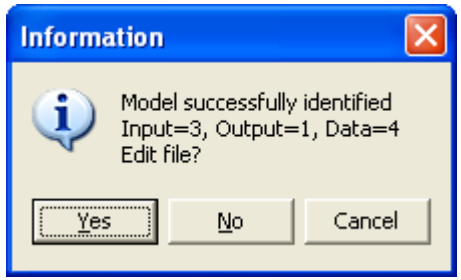


Right click



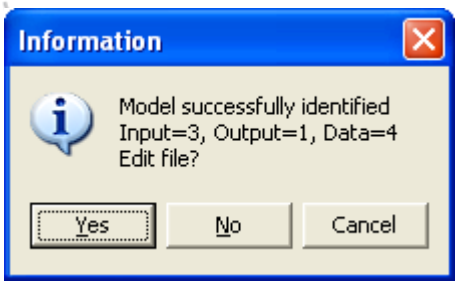
- The built-in text editor appears
  - Edit the text/Import
  - Click on Done



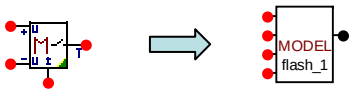


- Respond to the Model identified message

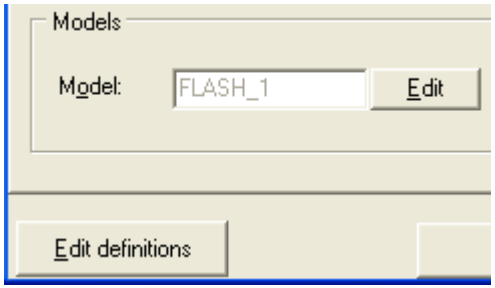
Go to Edit definitions



- Edit during identification
  - Click *Yes:* Go to Edit definitions
  - Click *No*: Accept default icon/node
- If the number of nodes has changed
  - ATPDraw will as default create a new icon in vector graphic style



- Edit definitions later
  - Click *Edit definitions*



Edit definitions

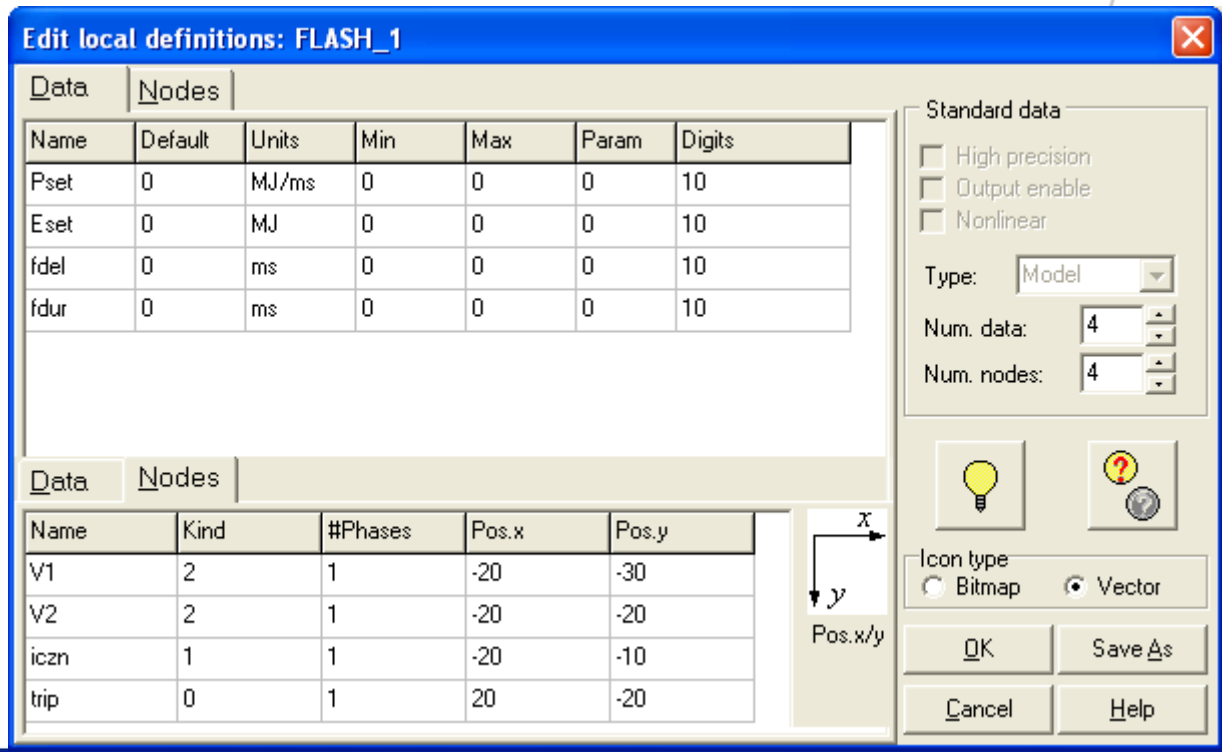
- Local: Component dialog|Edit definitions
- Global: Library|Edit|
- Edit data, nodes, icon, and help

Note:

Node positions changed from icon border 1-12 to (x, y) positions

Switch between bitmap/vector

Data|Unit added

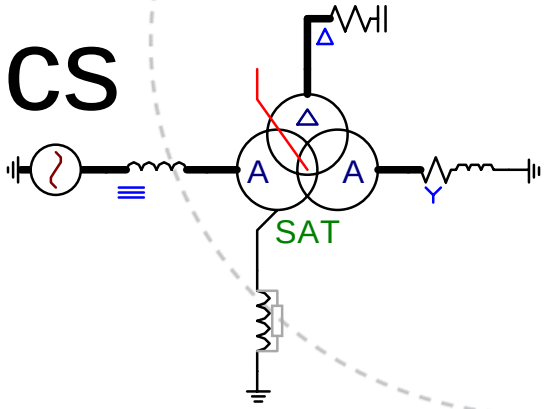


Latest news, version 5.1px

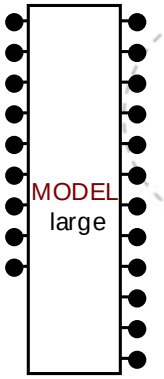
- Corrections to version 5 related to MODELS, User specified components, and LCC with equal names
- Improved integration of MODELS
- Indexed data to MODELS

- Version 5.2 prepared for the EEUG meeting 2007: New design

Vector graphics

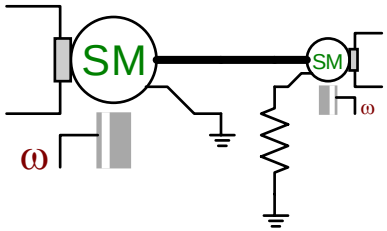


- Sponsored by EEUG (2007)
- Better zooming and dynamics

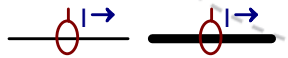
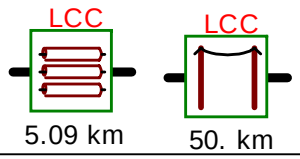
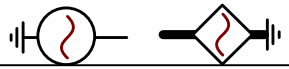
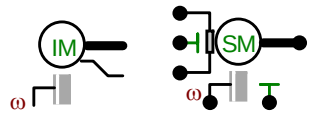
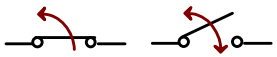
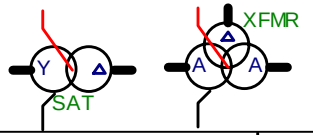
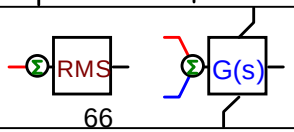


- Increased icon size 255x255 (from 41x41)
- Allow more nodes than 12

- Additional: Flipping & Individual scalable icons

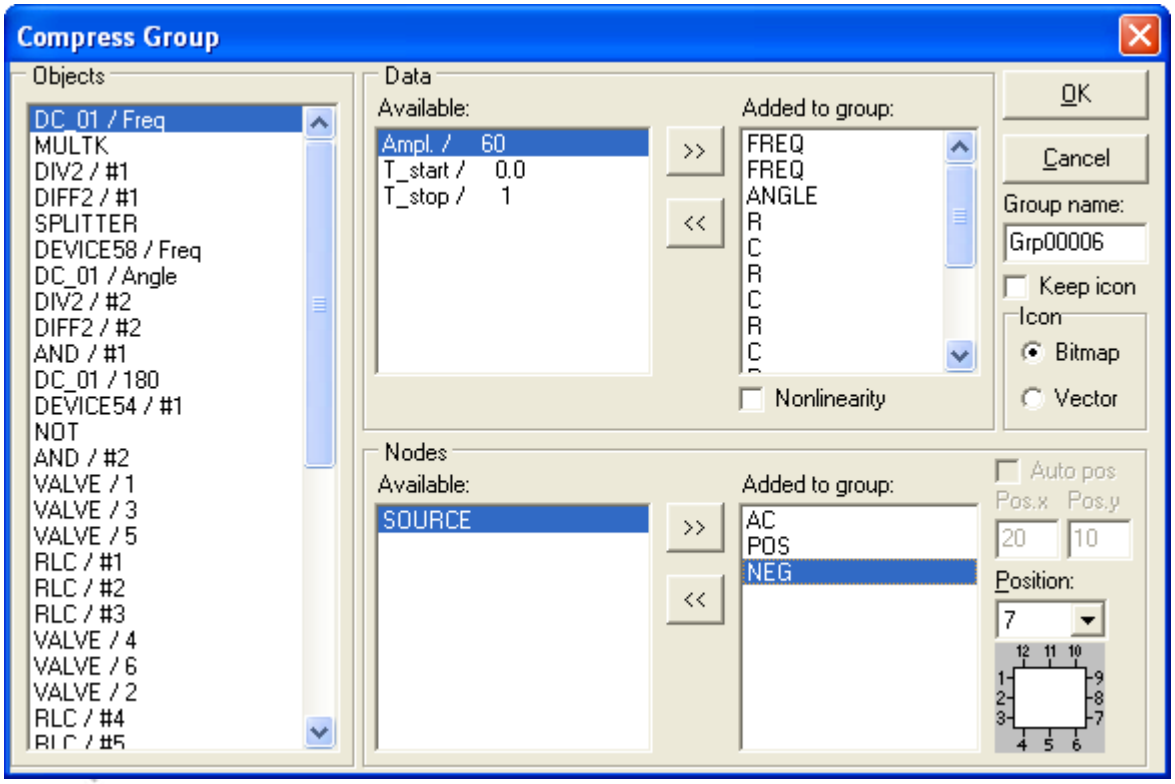


Dynamic icons

RLC, RLC3, RLCD3, RLCY3; R, L, C, RL, RC, LC, RLC appearance.	
PROBE_I (Current probe); Single phase or three phase appearance.	
LCC; Overhead line, single core cable, or enclosing pipe appearance. Length of transmission line optionally added.	
All sources; current (rhomb) or voltage (circle) source appearance.	
Universal machines; manual/automatic initialization, neutral grounding.	
TSWITCH (Time controlled switch); opening/closing indications.	
Transformers; Coupling (Wye, delta, auto, zigzag), two/three windings.	
TACS summation. Positive (red), negative (blue), or disconnected input. Click on the nodes to activate.	

Grouping

- Groups get default icon in vector style
- Compress/Recompress:



Note:

Group name: just for icon

Keep icon: in case of recompress

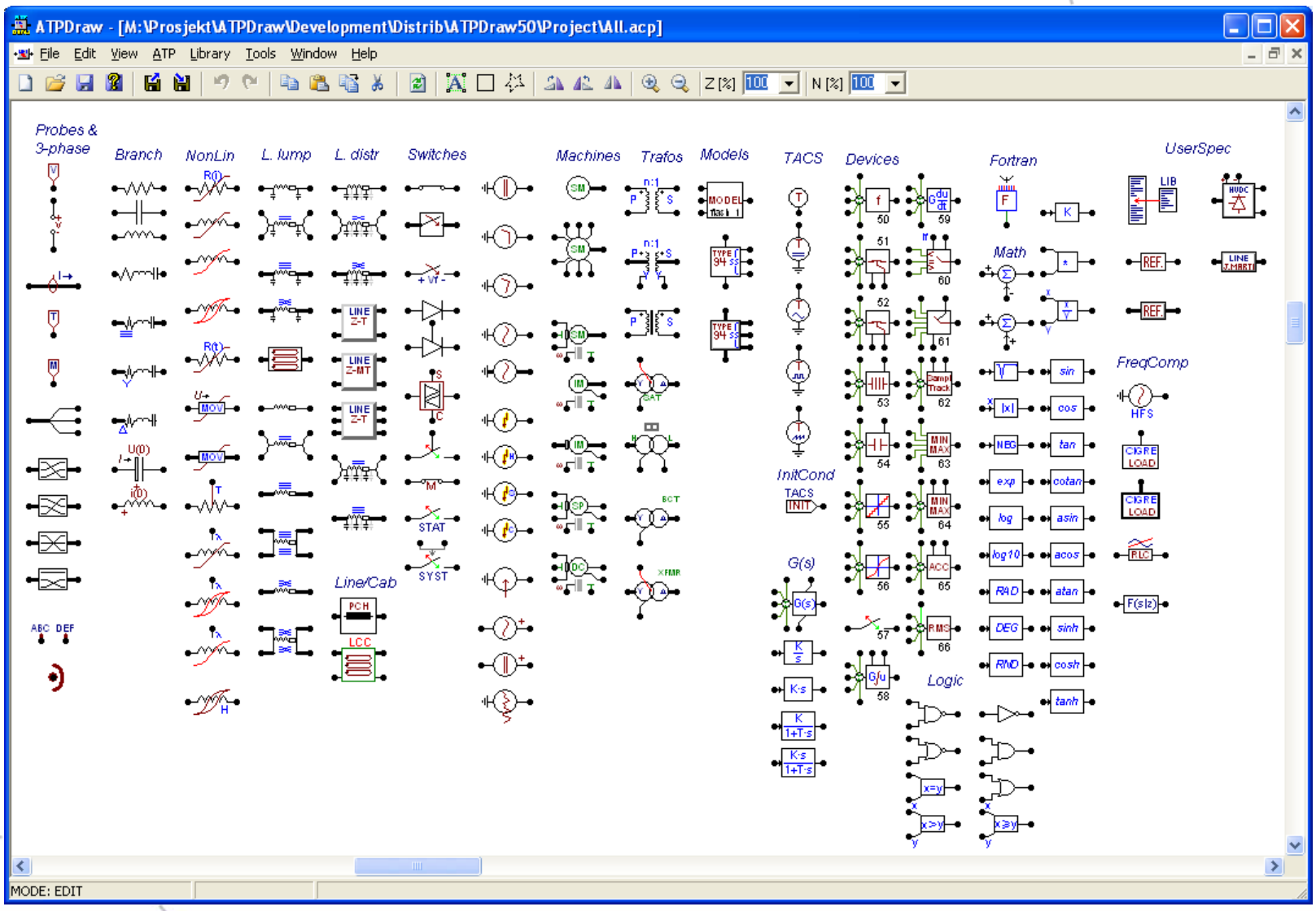
Choses between Bitmap/Vector

Vector supports automatic node positioning

Old style 1-12 borderpos kept

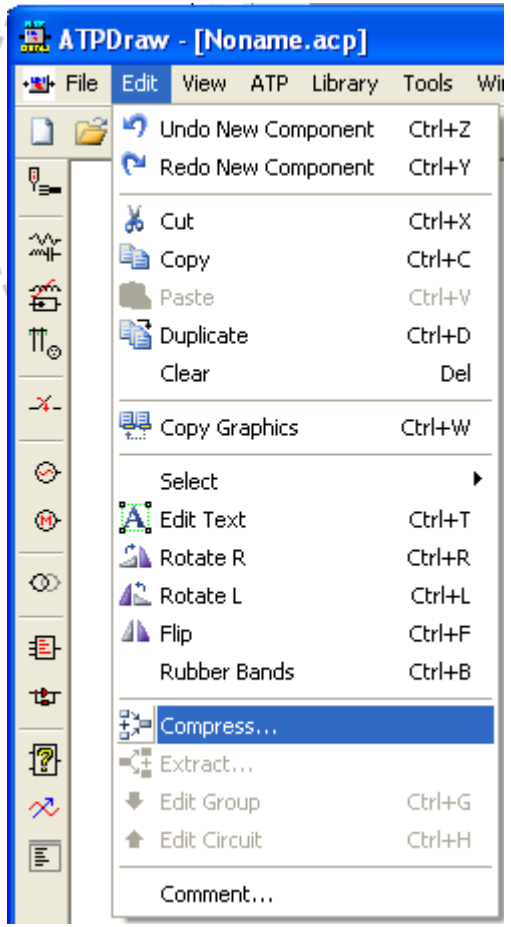
Specify Position=0 to enable (x, y) pos.

All standard components:



Other updates

- Facelift
  - Toolbar improvements.
  - Component bar option added.
  - Pull down menu icons.
  - More rotation options added.
- XFMR update
  - Bugfix
  - Extensive benchmarking
  - Support of Triplex core



Latest news, version 5.3

- Upgrade to a new compiler Delphi 2007, basically to better support the new help file standard.
- Upgrade of this help file system from HLP to CHM (HTML format).
- The main menu and toolbar are updated to Windows XP look and feel. New icons added for both toolbar and main menu. The toolbar is customizable. Elements are intentionally enabled and disabled.
- Support of "themed" design and real Windows XP/Vista appearance of buttons and tabs.
- Support of multi-lined text with individual font and color properties. Using the multi-line option will prevent older versions of ATPDraw to show the text correctly on screen.
- Option to give node names directly in the Component dialog re-introduced. User specified names are drawn with a red color.
- Several corrections in the Hybrid Transformer model. Zero sequence. Core losses, saturation curve small transformers. Frequency dependent winding resistance.
- Support of Triplex and Shell-form cores added to the Hybrid Transformer model XFMR.

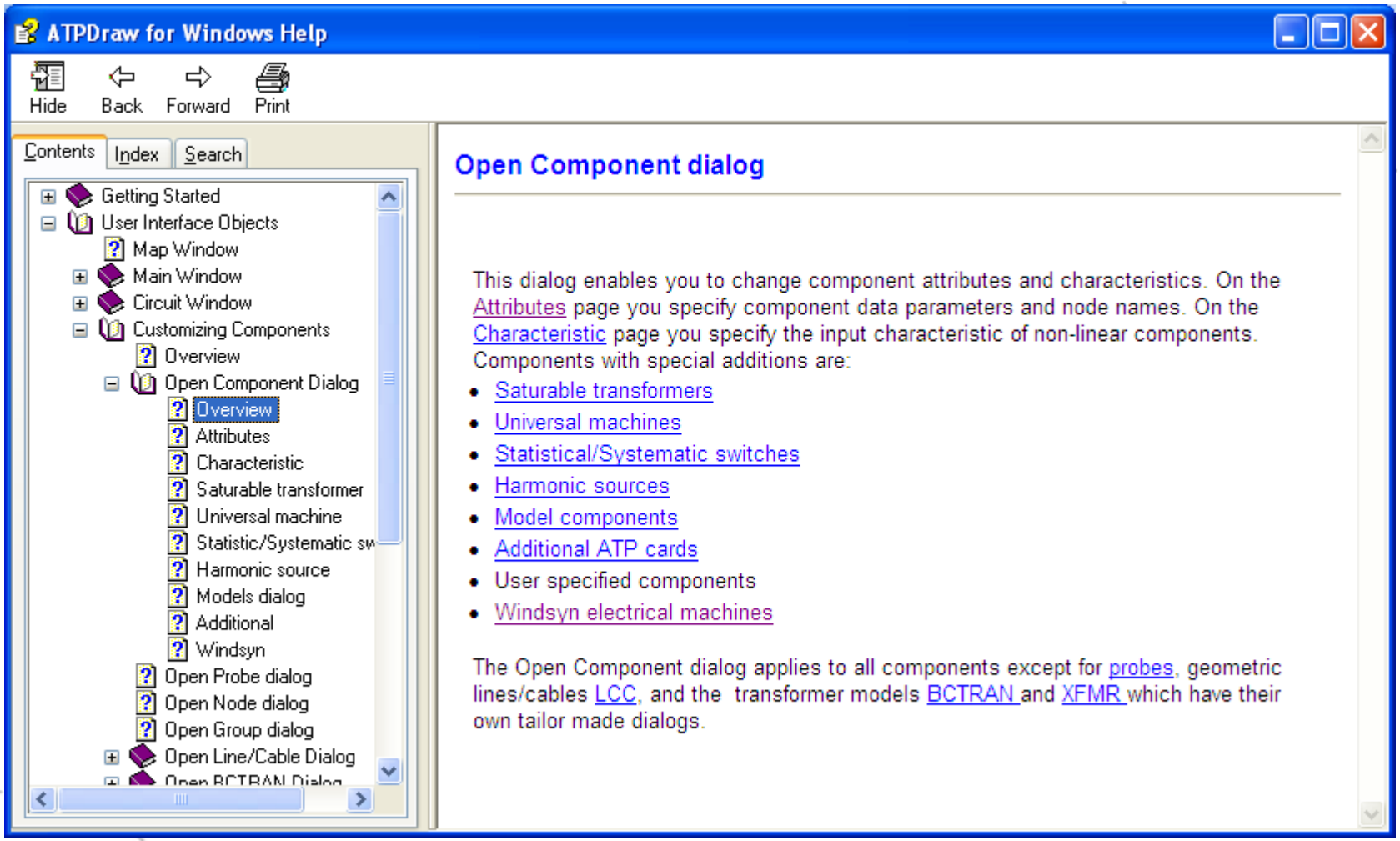
Latest news, version 5.3 cont.

- A connection's node dots can be individually forced on in order to produce a consistent drawing with all other node dots off.
- A Vector Graphic Editor available. Drawing, selection, rescaling of individual or all elements. Handling of node positions together with the icon. Support of rotated ellipses and rectangles. Support of pie shapes.
- Relations drawn as a dotted line. The relation property is available from the Connection dialog. A Relation can have a label and different colors just like a connection.
- A third page 'Nodes' added to the LCC dialog which allows the user to change the node names and assign the individual conductors to the terminals. This could be useful for more complex cable systems.
- The LCC dialog is rewritten to give a better handling of the Name and better support of Cancel.
- Error in Copy/Paste nonlinear characteristic corrected.
- Shortcut keys Alt+F1-F12 added to the Edit Definition/Support dialog (and Vector Graphic editor) to support the "old" icon border node positions (1-12) co-ordinates.
- Alt+click to select texts, node names, or labels instead of the Ctrl key. Ctrl+P/V followed by a rapid click on the pasted component resulted in an unexpected shift to Edit Text mode.

New help file system

- The old hlp standard not supported in VISTA by default
- Switch to html help was necessary
  - Conversion of old help file
  - Update the help file system
- Benefit
  - Content-Navigation
  - Search

HTML help: atpdraw.chm

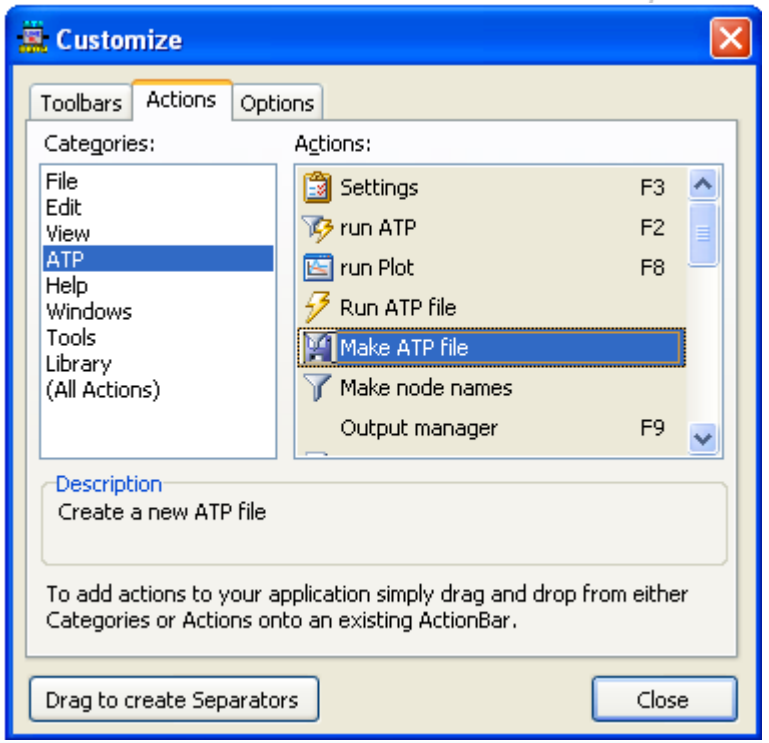


Layout

- ”Themed design”
  - Utilizing the new Windows graphic routines
  - Dynamic mouse drag-over response
    - Main menu and tool bar
    - Tabbed pages, check boxes and buttonss
    - Combo, spin edit, and scroll boxes
- Actions
  - Automatic disabling/enabling of menu items
  - Customizable toolbar
- Layout comparable to standard programs

Customize toolbar

- Select View|Toolbar customize
  - Drag items on/off the toolbar
  - Select category and drag on:

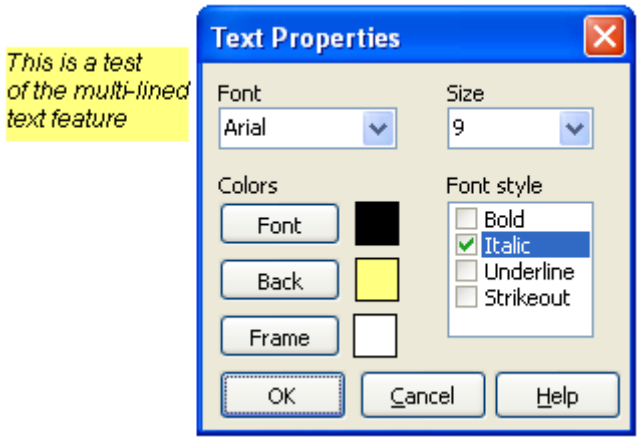


Stored in:

APPDATA\atpdraw\Toolbar.cfg

Multi-lined text

- Support of multi-lines text with properties
  - Font
  - Size
  - Colors
  - Style



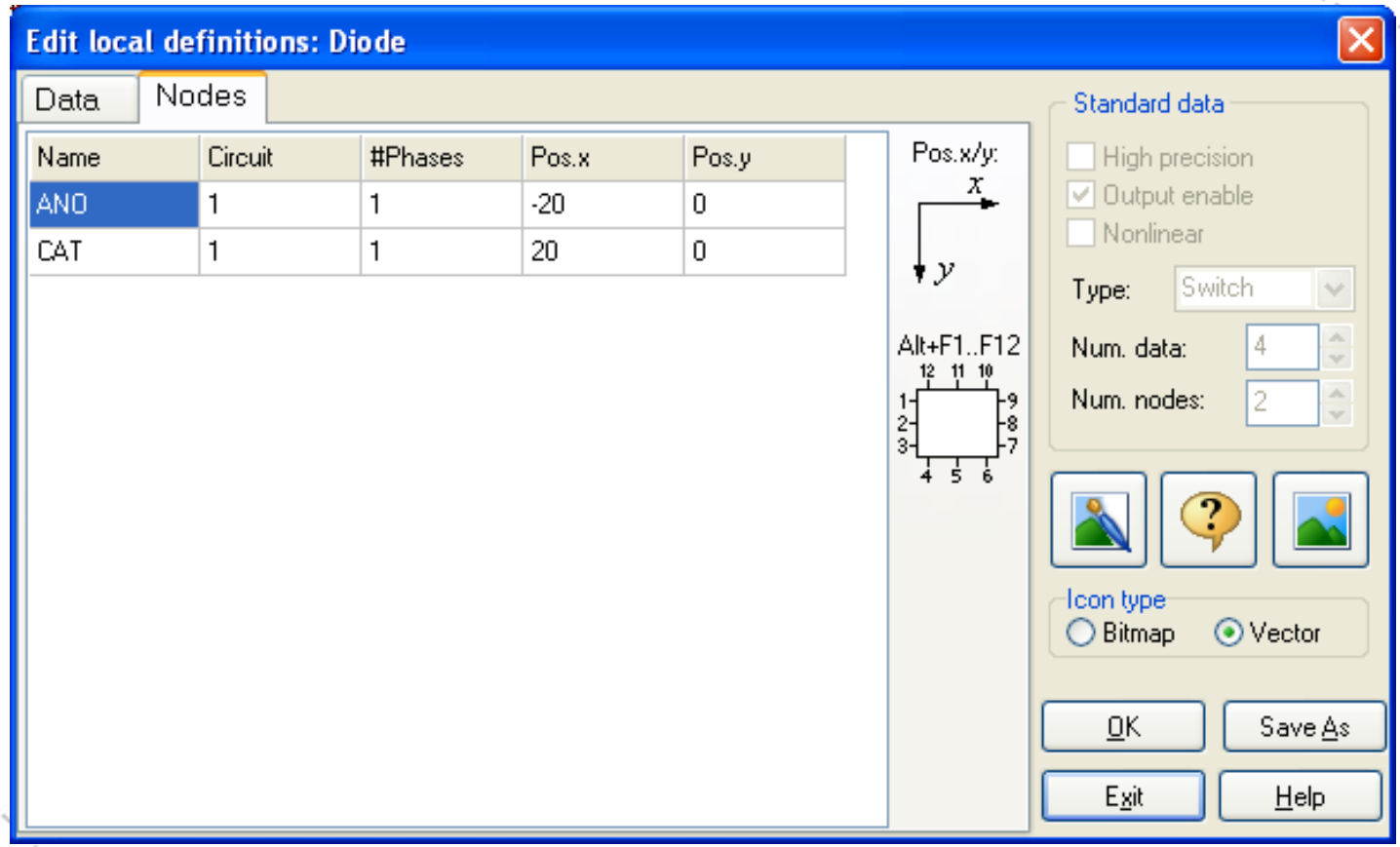
- 2 GB (!) maximum text size

Latest news, version 5.4

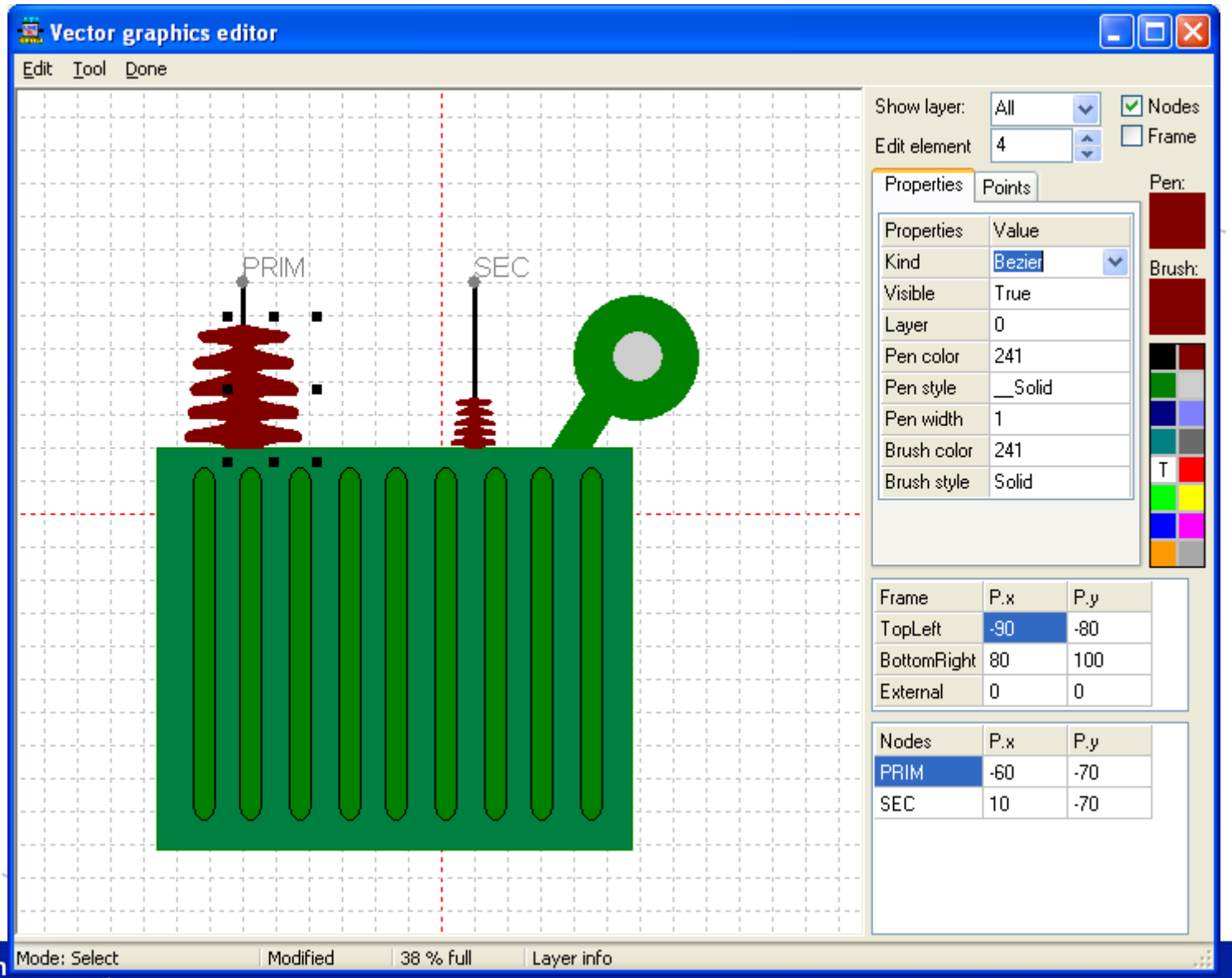
- Vector graphic editor significantly enhanced.
- Possible to add a standard bitmap background to component icons, including scaling and rotation.
- Output Manager. ATPDraw lists all output requests and gives the user direct access to each of them. Includes also a statistical tabulation option with scaling and grouping.
- Additional cards moved to separate new component under User specified in the selection menu. Follows standard edit operations including Hide and Sort. Inclusion of request templates via the built-in text editor's context menu (right click).
- Models Record moved locally into each model component.
- All results files stored in memory (also for LCC and BCTRAN). $Include files dumped to the result directory (user selectable ATP or project folder) each time the final ATP file is created. No more any risk of file sharing conflicts with simultaneously open projects. No initial request for ResultDir. BCTRAN result file stored in project.
- User extendable Selection menu. Add frequent used sub-circuits to the selection menu.
- Protection of Groups, Models and User Specified components.
- Hybrid Transformer model benchmarked and corrected.
- Windsyn integration supported.

Edit definitions

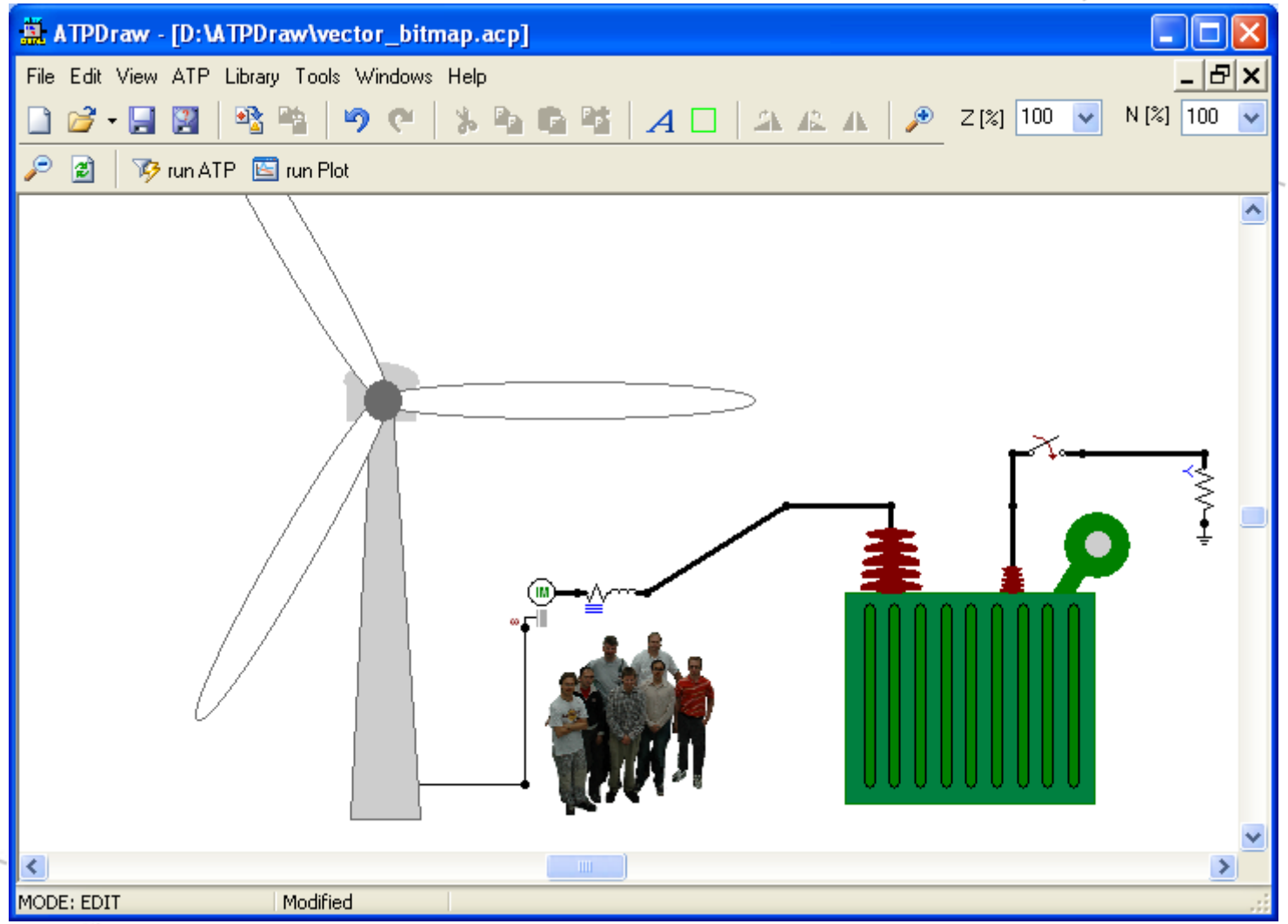
- Edit icon/backiground/help/nodes/data



Vector Graphic Editor

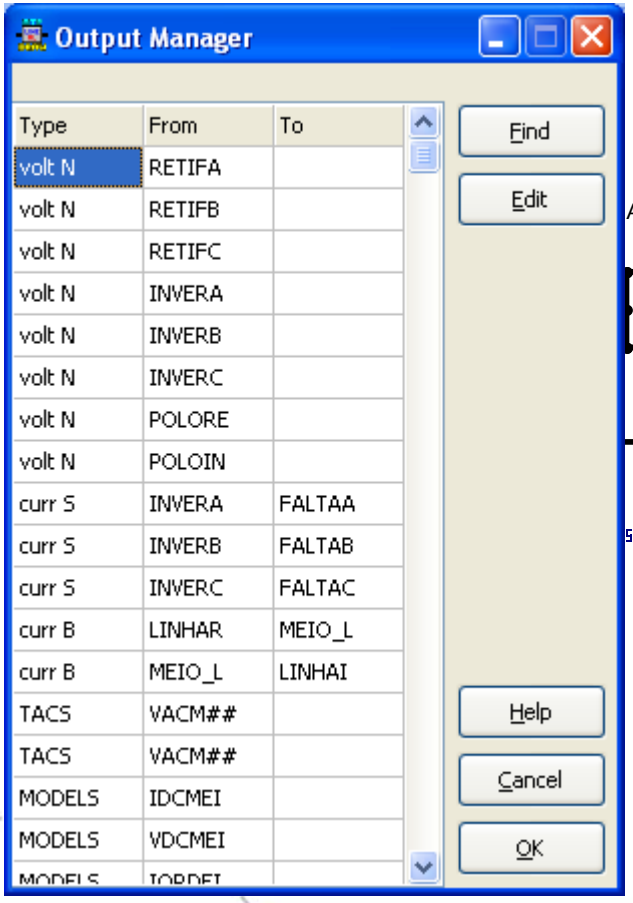


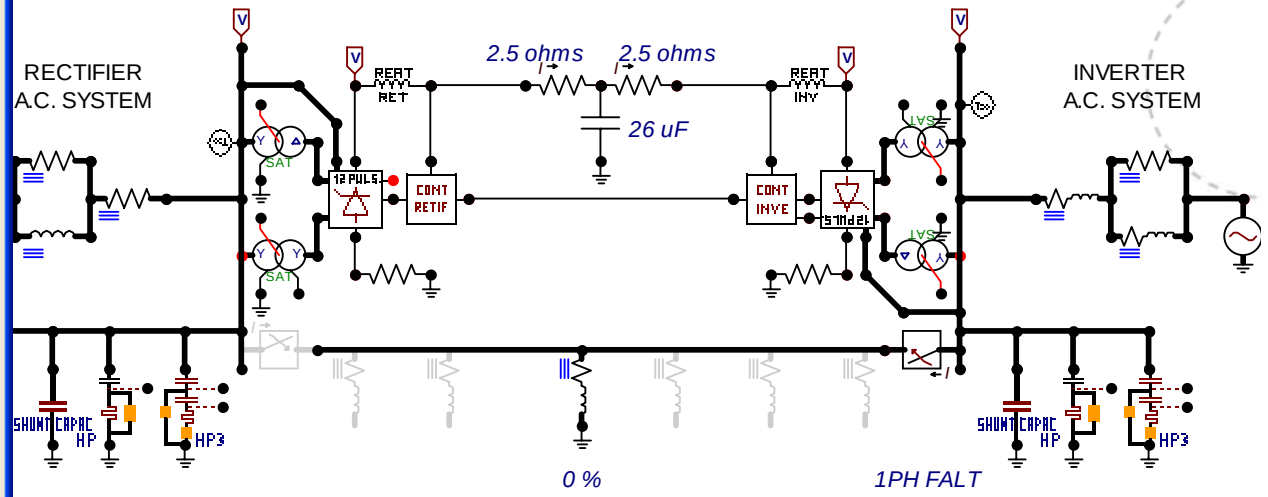
Add bitmap background



Output manager

- ATP|Output manager F9



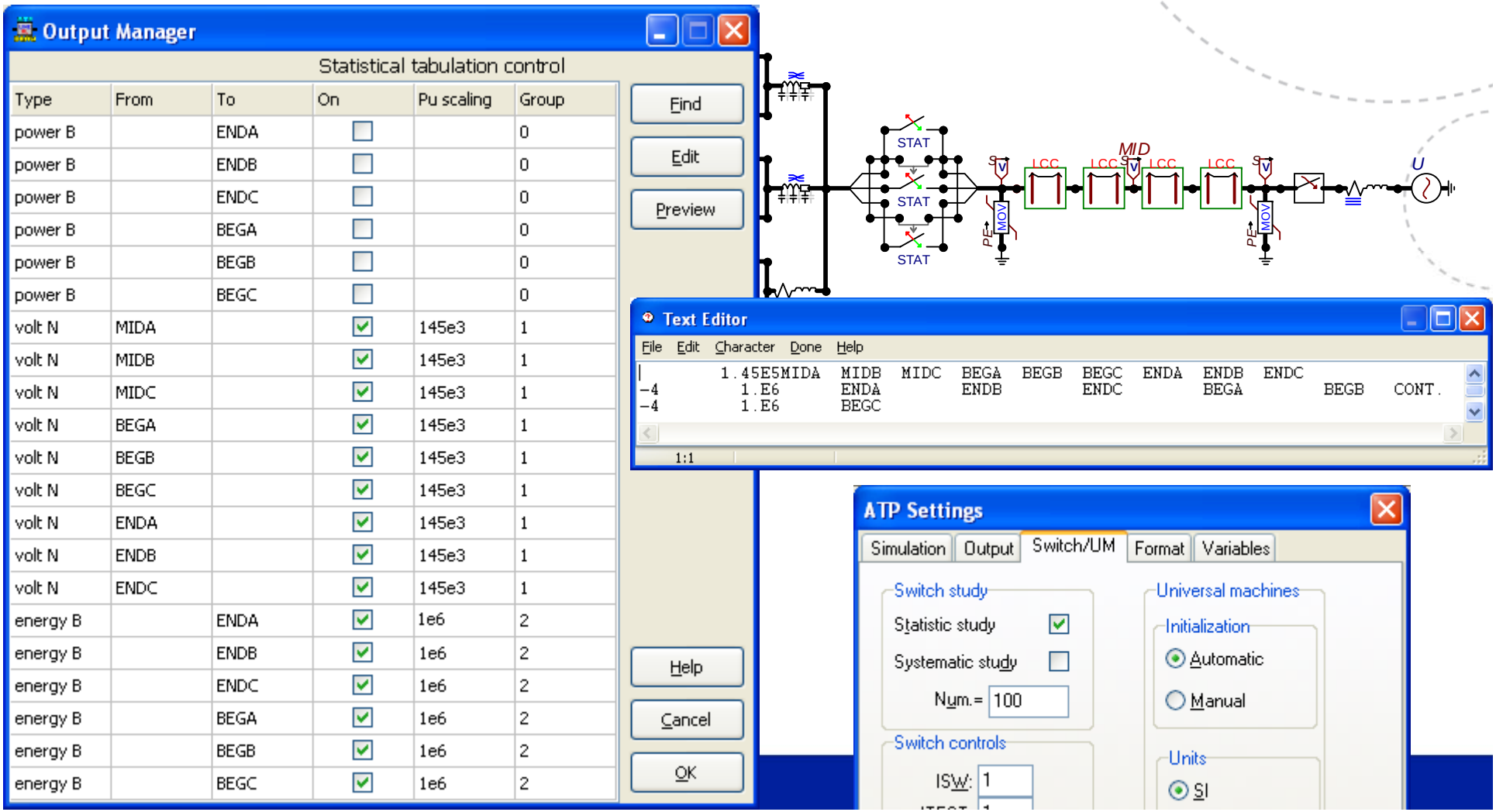


Find: Centre and highlight the involved component

Edit: Show the dialog box of the involved component

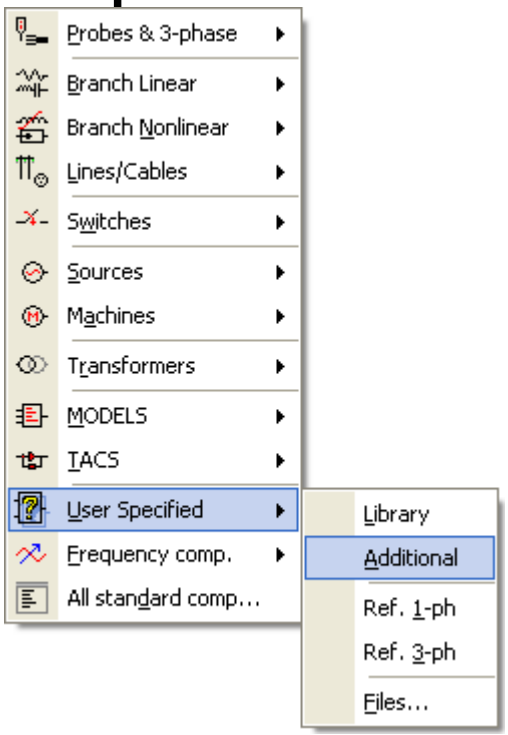
Statistical tabulation

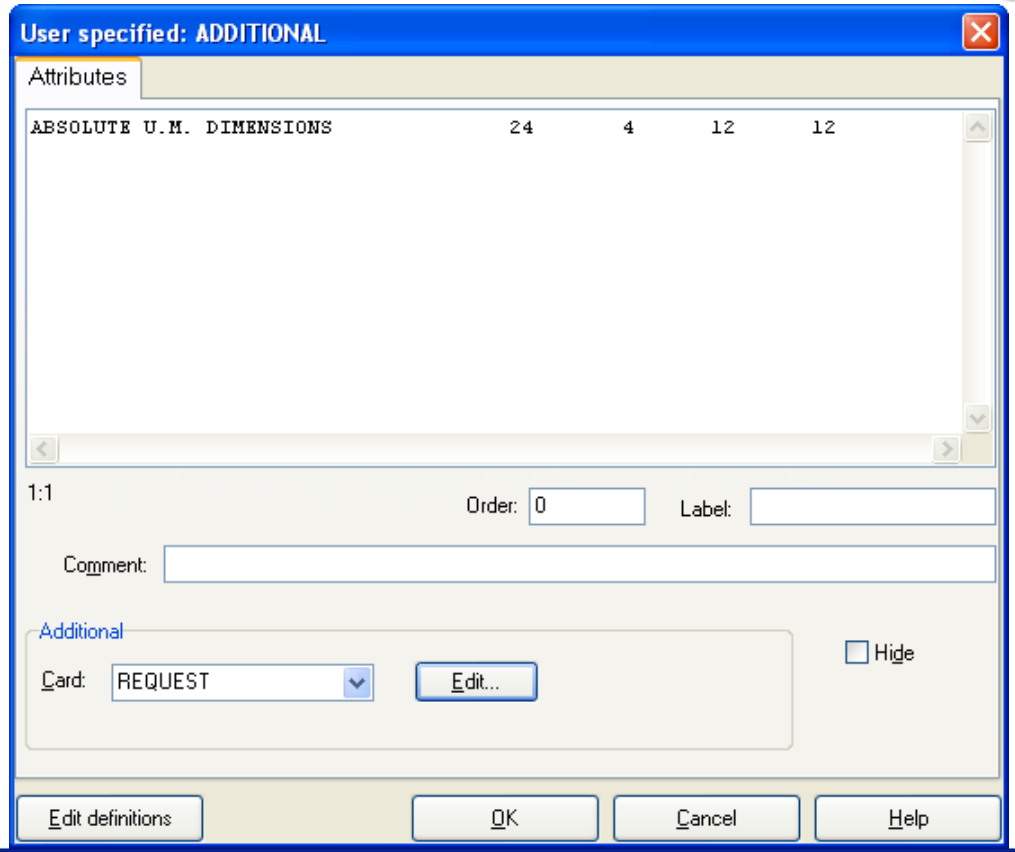
- Addition to output manager


Output Manager
Statistical tabulation control
Type | From | To | On | Pu scaling | Group
power B | | ENDA | | | 0
power B | | ENDB | | | 0
power B | | ENDC | | | 0
power B | | BEGA | | | 0
power B | | BEGB | | | 0
power B | | BEGC | | | 0
volt N | MIDA | | ✓ | 145e3 | 1
volt N | MIDB | | ✓ | 145e3 | 1
volt N | MIDC | | ✓ | 145e3 | 1
volt N | BEGA | | ✓ | 145e3 | 1
volt N | BEGB | | ✓ | 145e3 | 1
volt N | BEGC | | ✓ | 145e3 | 1
volt N | ENDA | | ✓ | 145e3 | 1
volt N | ENDB | | ✓ | 145e3 | 1
volt N | ENDC | | ✓ | 145e3 | 1
energy B | | ENDA | ✓ | 1e6 | 2
energy B | | ENDB | ✓ | 1e6 | 2
energy B | | ENDC | ✓ | 1e6 | 2
energy B | | BEGA | ✓ | 1e6 | 2
energy B | | BEGB | ✓ | 1e6 | 2
energy B | | BEGC | ✓ | 1e6 | 2
Find
Edit
Preview
Help
Cancel
OK
STAT
STAT
STAT
MID
LCC
LCC
LCC
LCC
MOV
MOV
PE
PE
U
Text Editor
File Edit Character Done Help
1.45E5MIDA MIDB MIDC BEGA BEGB BEGC ENDA ENDB ENDC
-4 1.E6 ENDA ENDB ENDC BEGA BEGB CONT.
-4 1.E6 BEGC
1:1
ATP Settings
Simulation
Output
Switch/UM
Format
Variables
Switch study
Statistic study
Systematic study
Num.= 100
Switch controls
ISW: 1
Universal machines
Initialization
Automatic
Manual
Units
SI

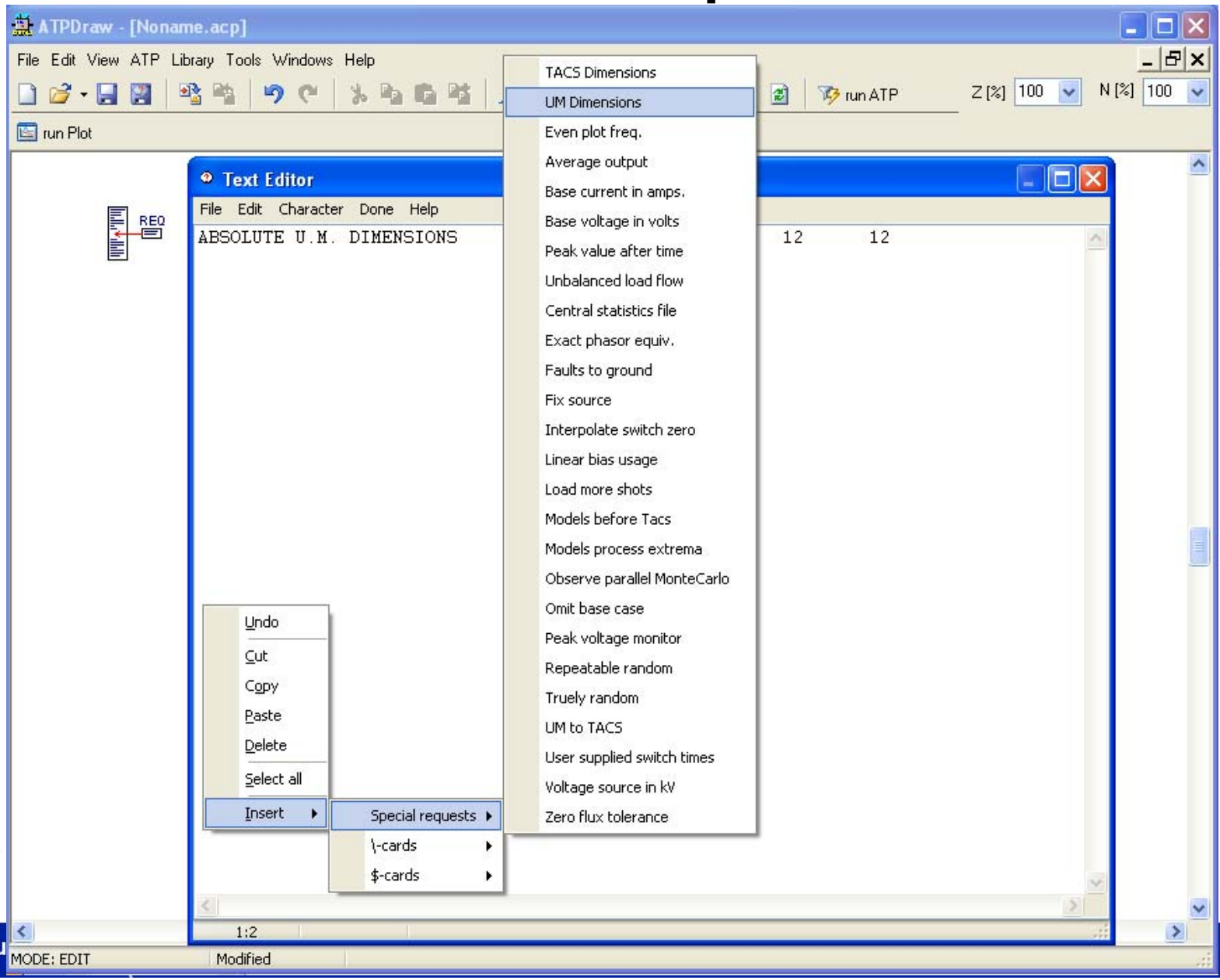
Additional cards

- Moved from ATP|Settings/Format to separate component



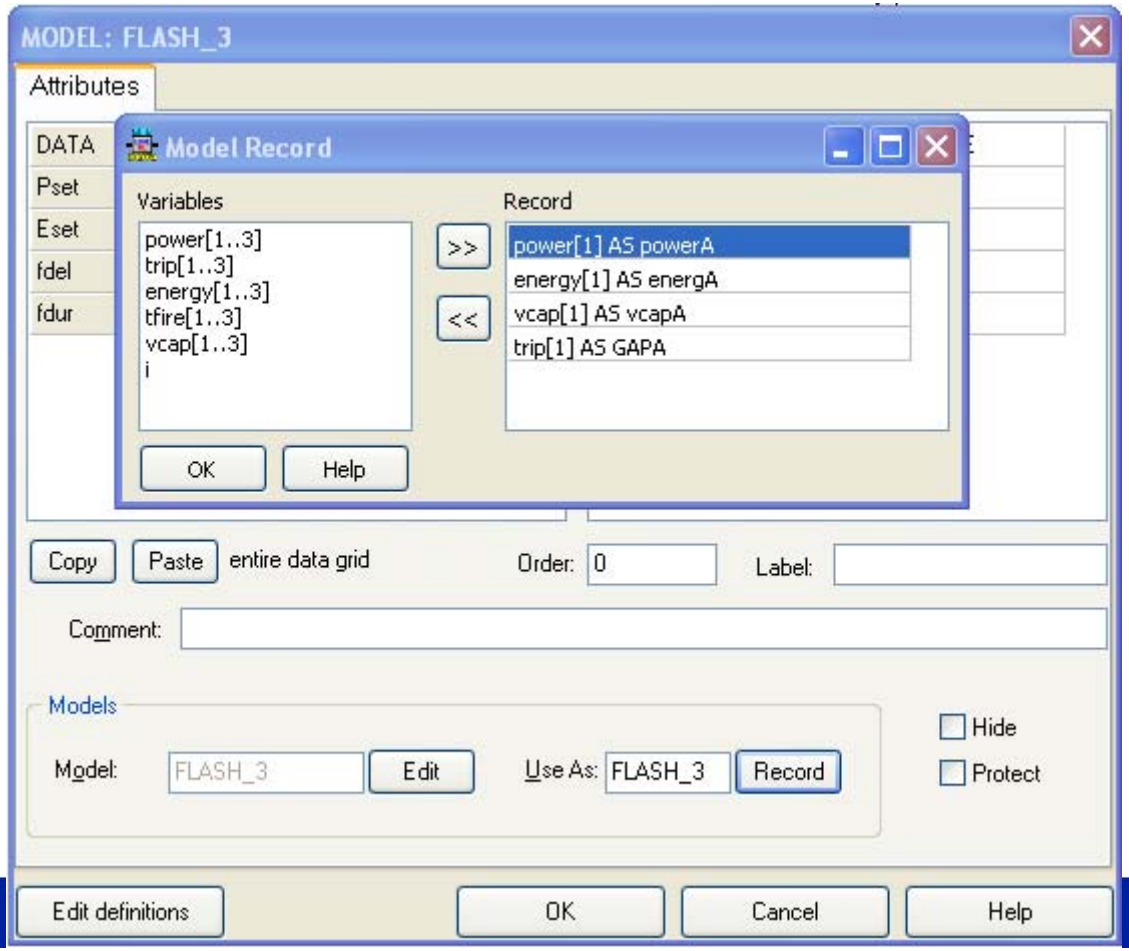


Insert templates



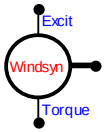
Models RECORD

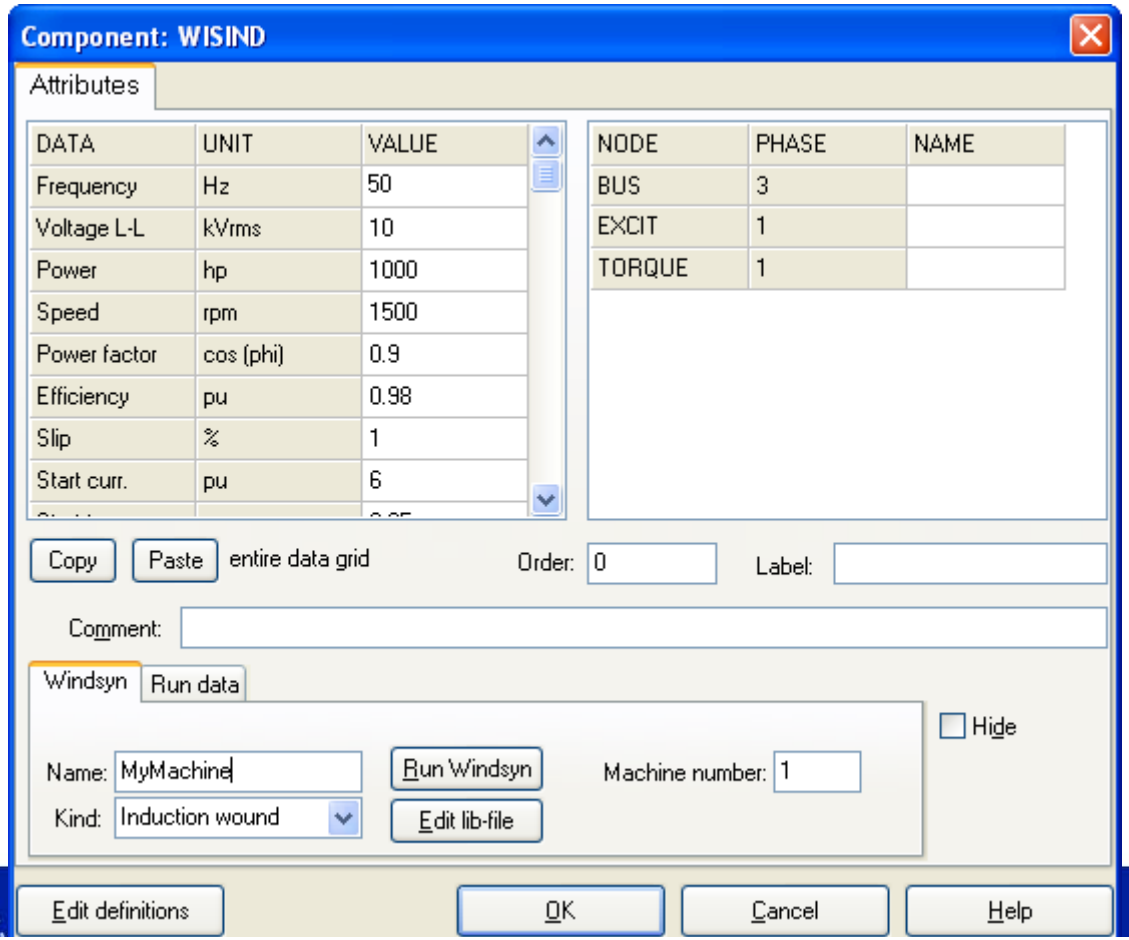
- Moved from ATP|Settings to locally in Model component



Windsyn integration

- Execution of Windsyn from ATPDraw
- Storing data properly in the project file





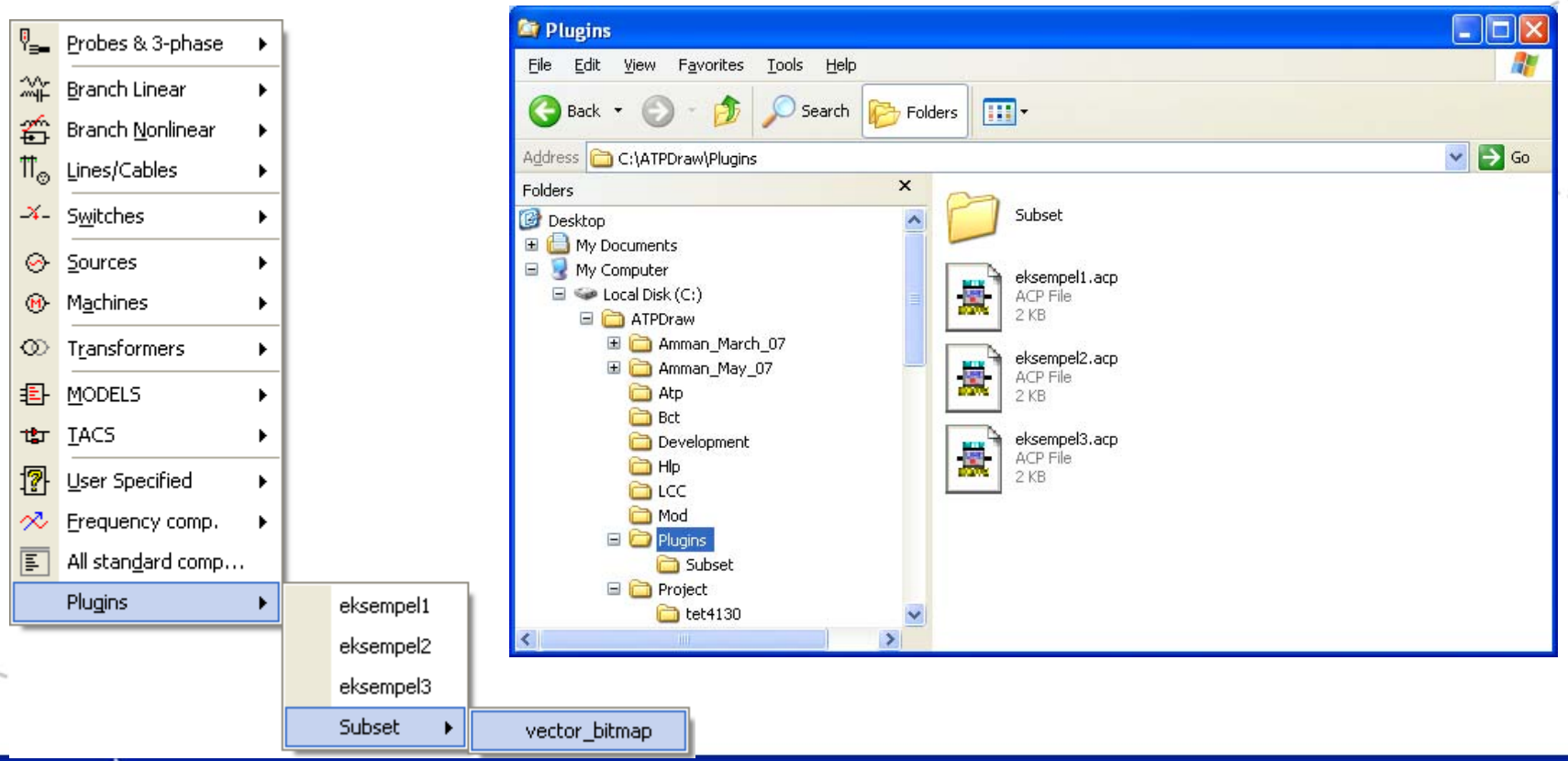
Exciter and governor under development

Protection

- Groups + Models + User Specified
- Password to open and edit component
- Edit definitions, Make ATP file, Edit Group restrictions
- $LISTOFF-$LISTON used to protect lis-file
- ATP file dumped to disk when Run ATP (F2) is clicked
  - Saved with a random name
  - Modified after 2 seconds; $LISTOFF blocks removed, renamed to user specified name.

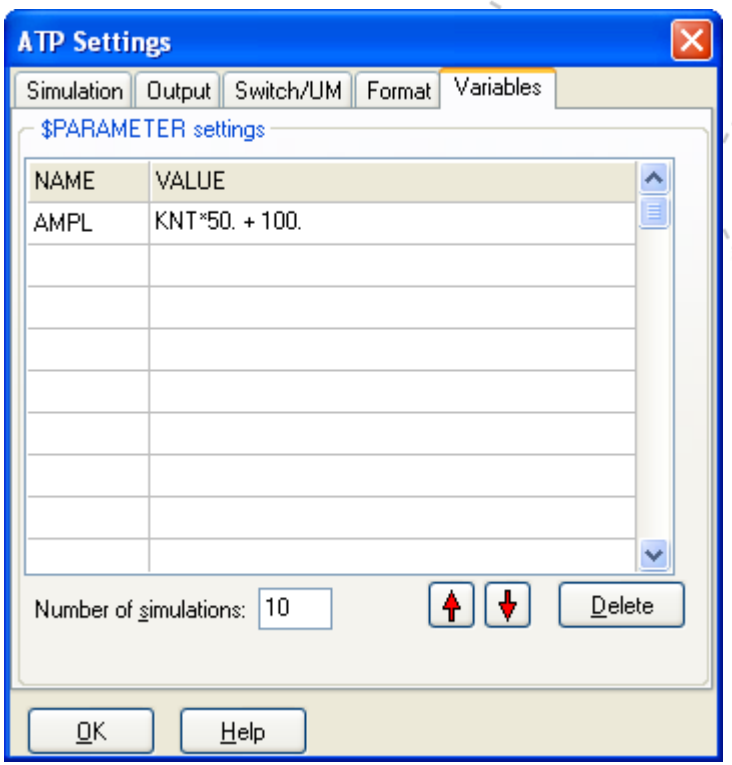
Selection menu

- User extendable – Import project file
- Create directory structure under /Plugins



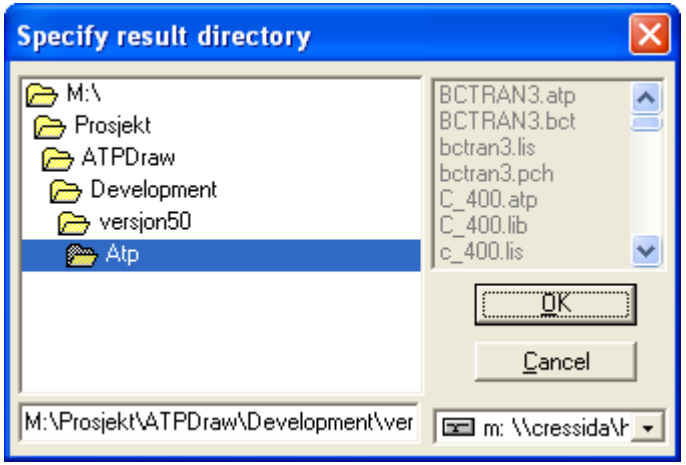
Pocket calculator pl4

- Multiple runs via Pocket calculator creates plot file on the form MyCircuit.001, MyCircuit.002,.., MyCircuit.100
- These files can not be read by PlotXY
- ATPDraw adds '.pl4' to the file name if they can be found on disk



Result Directory

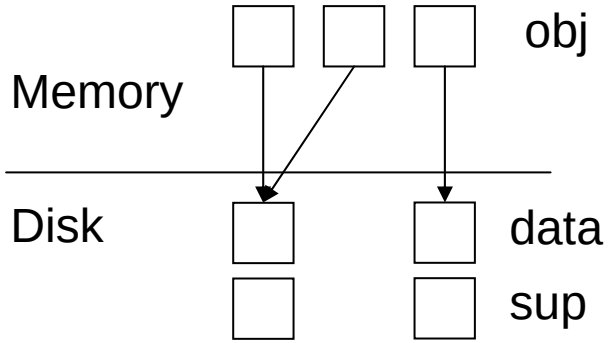
- The user initially specifies where the result should be stored (ATP and $Include files)
  - Introduced in version 5
  - Removed from version 5.4



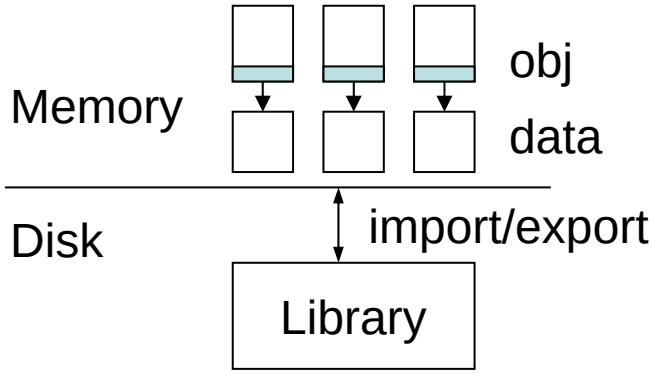
- ATPDraw.ini file stored in APPDATA/ATPDraw

Data files in memory

Old:



New:

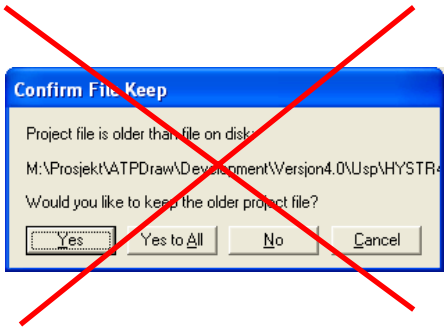


Problems:

- Where? Lots of files/messy disk
- Is it safe to delete files?
- Conflicts between projects

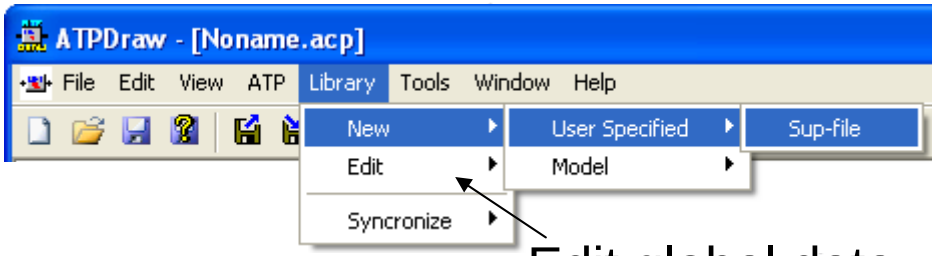
Solutions:

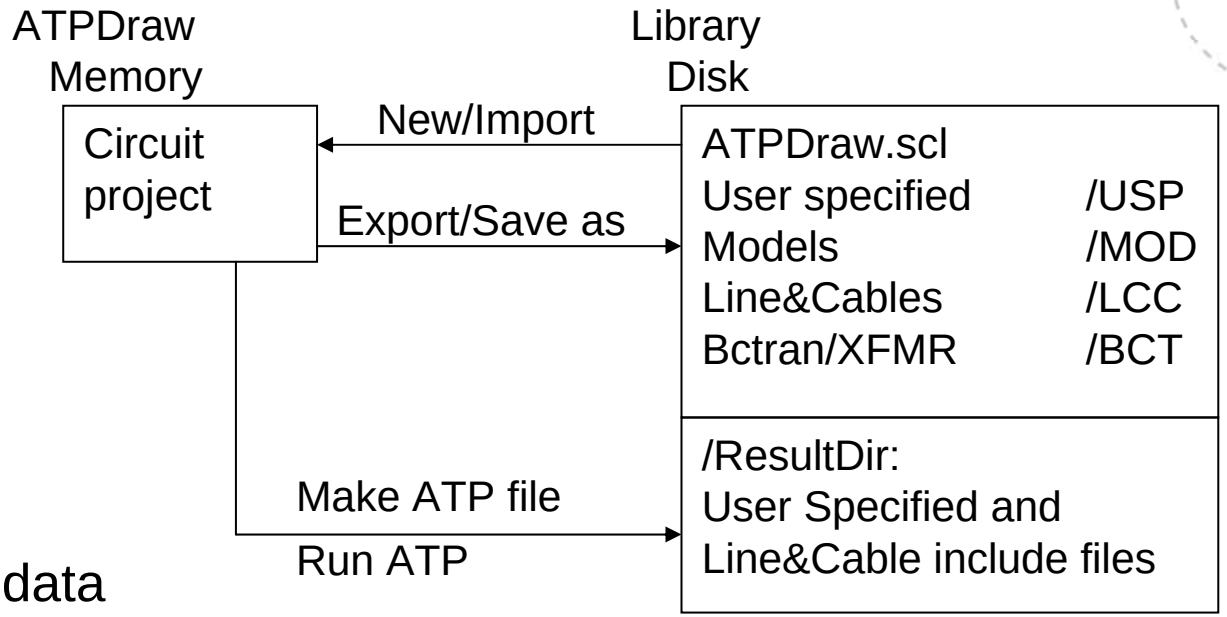
- All data in memory
- Files extracted to disk 'just in time'
- Import/Export allowed
- Project file contains all required information

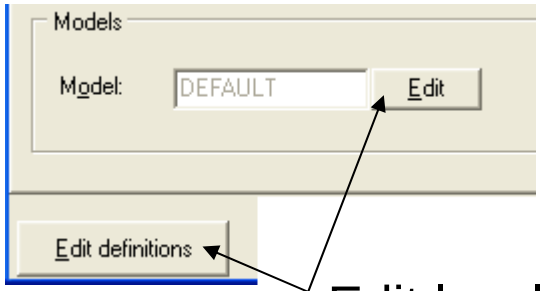


Project vs. Library: Local|Global

- When a new component is added to the project:
- All information copied into the project
- No links to files







Types of files

- Project file (acp): Contains all circuit data.
- Support file (sup): Component definitions. Used only when a component is added to the project.
  - Standard components: ATPDraw.scl
  - User defined components: Optionally in global library
- Data file (mod/alc/bct/xfm): Contain special data
  - Stored internally in data structure
  - Optionally in global library
- Help file (sup/txt): User specified help text
  - Global help stored in sup-file or /HLP directory (txt file)
  - Local help created under *Edit definitions*